SCIENTIFIC AMERICAN

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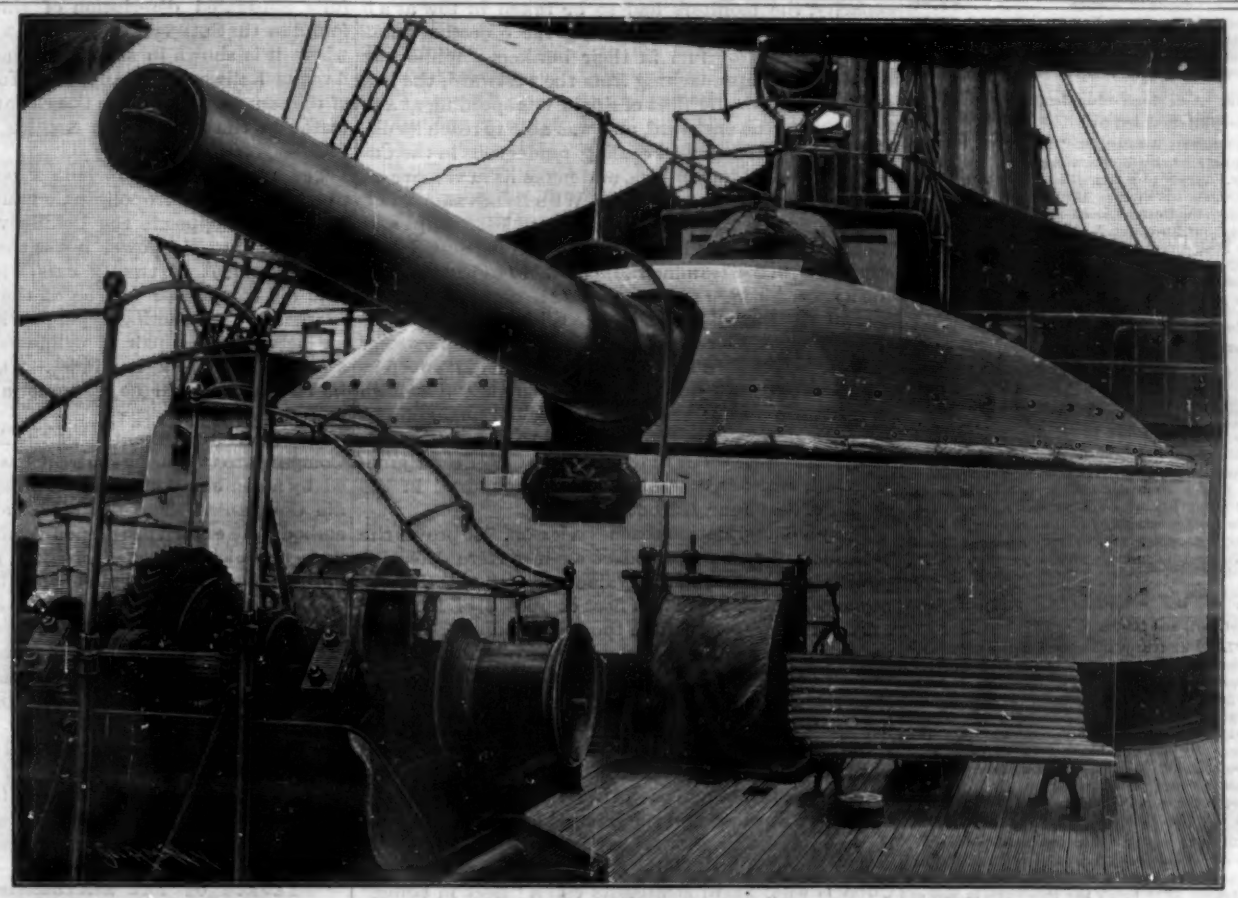
THE SPANISH "CAPE VERDE" FLEET.

The center of interest in the present war is quickly shifted. One week it lies off the south coast of Florida as our blockading fleet moves to the investment of Cuba: the next week it is found off the coast of Africa, where we see the Cape Verde fleet gathered for its long voyage to the relief of the Spanish army; then it flies to the antipodes and we watch the fateful conflict of Manila; and before we have had time to estimate the full value of the victory, the startling news comes that the Cape Verde fleet, which was supposed to be at Cadiz, is in the West Indies, replenishing its bunkers and getting otherwise ready for its campaign of diversion and relief of the blockaded island of Cuba.



THE FORWARD 11-INCH RIFLE OF THE "VIZCAYA."

Weight of shell, 694 pounds; velocity, 2,034 feet per second; muzzle energy, 34,030 foot-tons; muzzle penetration, 28·7 inches of iron.

Unless it is sunk or captured by our squadrons, the Cape Verde fleet is likely to fill a large page in the record of the Spanish-American war, for it happens to combine several qualities which are essential to successful fleet maneuvers. In the first place it is homogeneous, three of the armored ships being sister vessels and the fourth so nearly like them that, for tactical and maneuvering purposes, the four ships are identical. The three torpedo boat destroyers are also identical in armament and general

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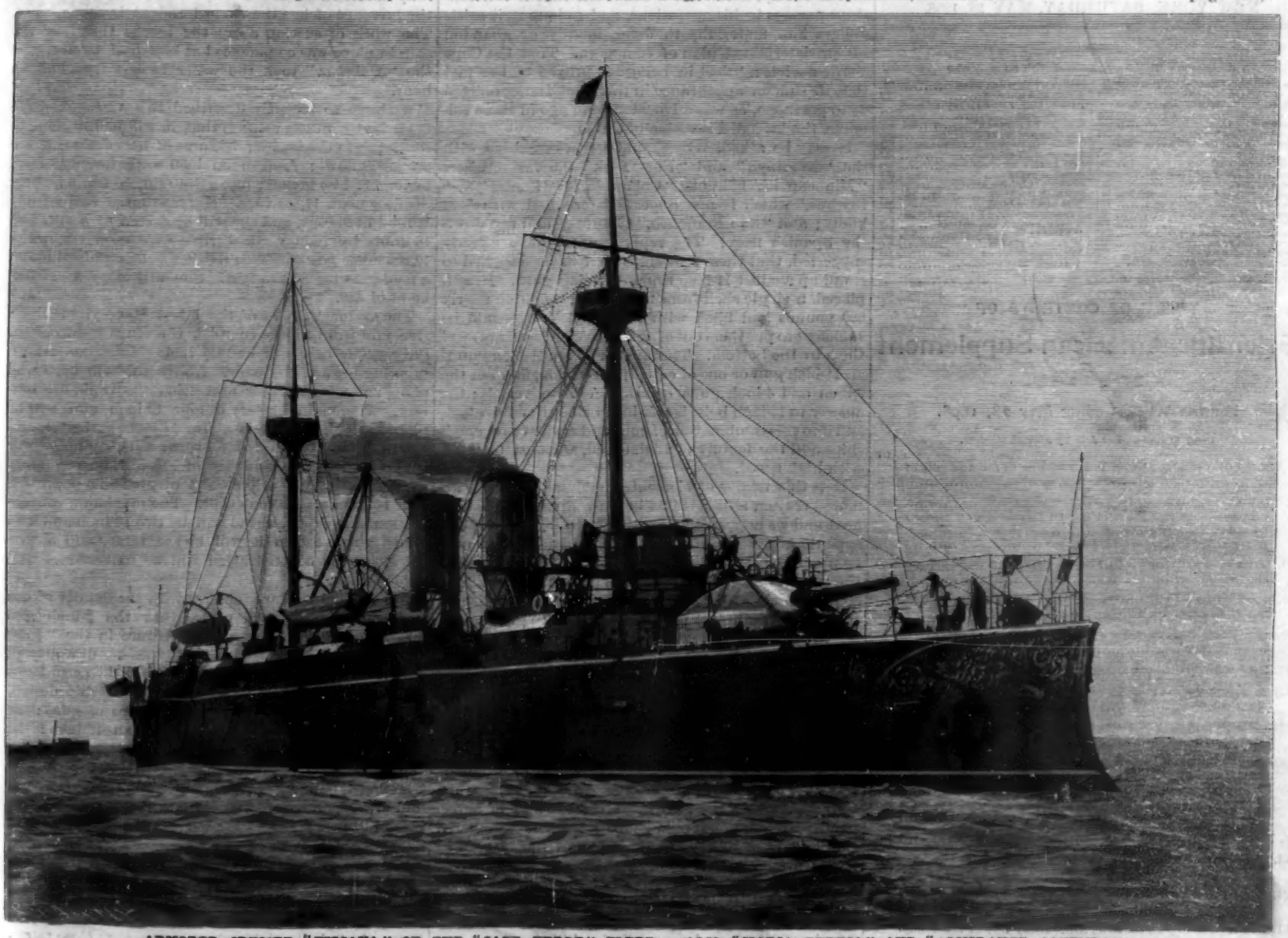

ARMORED CRUISER "VIZCAYA," OF THE "CAPE VERDE" FLEET. (ALSO "MARIA TERESA" AND "ALMIRANTE OQUENDO.")

DISPLACEMENT, 7,000 tons. HORSE POWER, 18,000. SPEED, 21 knots. ("Teresa," 20·25 knots; "Oquendo," 20 knots.) ARMOR: Belt, 12 inches; deck, 3 inches; barbettes, 10½ inches. ARMAMENT, two 11-inch, ten 5½-inch rapid-fire, two 9-pounders, eight 6-pounders, four 1-pounders, two machine guns. TORPEDO TUBES, six (two submerged). COAL CAPACITY, 1,200 tons. COMPLEMENT, 500.

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THE WEAK POINT IN OUR NAVY.

There is much food for thought on the part of our Board of Naval Strategy as it watches the game of hide and seek which is being played between Admiral Sampson's powerful, slow-moving battleships and the elusive fleet of armored cruisers under Admiral Cervera. The fleet that crept slowly along the northern coasts of Cuba and Hayti, its speed restricted by an inexorable law to the speed and coal capacity of its harbor defense monitors, was the embodiment, as far as guns and armor go, of the very highest powers of attack and defense. But with a trial speed of 10·5 knots, a probable sea speed of 7 or 8 knots, and a very limited coal capacity, the monitors had to be taken in tow at a 5 knot gait, to insure their reaching the objective point with a reserve of fuel in their bunkers. While our squadron was approaching from the westward, the less powerful but swifter fleet of Spain was speeding at a 12 knot gait to the eastward, and was able to reach its objective and prearranged coaling rendezvous in the Caribbean Sea, fill its bunkers, and make its next move on the checkerboard unmolested. With its advantage of 8 or 10 knots over Sampson's squadron of battleships and monitors and of 3 or 4 knots over the "Flying Squadron," coupled with its steaming radius of 7,000 to 10,000 knots, the armored cruisers were now free to make any one of several diversions in favor of the beleaguered island of Cuba. They might run to Porto Rico and take up a strong position under the guns of the fort; they might sweep in a wide circle to the eastward of the islands and menace our Atlantic coasts; or they were free to remain off the Venezuelan coast, drawing our fleets to the southward, and then speed swiftly to the northeast to effect a junction with a possible second Spanish squadron in the shelter of San Juan Harbor.

The present situation teaches a lesson. It proves the usefulness of speed as an offset against mere defensive power, and the inestimable value of speed and offensive power when combined in a fleet composed of identical armored vessels. Although the Spanish cruisers are not capable of contending with our battleships and are certain to be sunk if they attempt it, they would be more than a match for our two armored cruisers the "Brooklyn" and "New York," which are our only armored ships having sufficient speed to hunt them down, and it would certainly go hard with our unarmored and scattered scouting and patrol fleet if Cervera should run to the eastward around the Sampson and Schley squadrons and make a raid up the Atlantic seaboard.

The Spanish fleet in its relation to our blockade of Cuba is what naval strategists call a "fleet in being," that is to say, a fleet which, while it is inferior in strength to the enemy, is in such a condition that it is a constant menace to his operations, and as long as it exists obliges him materially to defer, modify or abandon his predetermined plan of campaign. That the Cape Verde fleet is a "fleet in being" is proved by the fact that its sudden appearance in the West Indies obliged us to postpone, as was advocated long ago in these columns, the intended invasion of Cuba.

It may be asked, Why should we not combine with the "Brooklyn" and "New York" the fast cruisers "Minneapolis," 23 knots; "Columbia," 23·8 knots; "New Orleans," which it now appears is credited with 22½ knots; and "San Francisco," 20 knots; and run down the Spanish fleet? The reply is, as we have already suggested, that these four ships were never designed to stand up against 11-inch armor-piercing guns. If well placed, a single shell from these guns, weighing nearly 600 pounds and filled with high explosives, would be sufficient to put them out of action, even if it did not send them to the bottom. The answer to an 11-inch gun is an 11-inch gun or one of equal penetration, and not the 6-inch and 4-inch guns carried on these vessels; the answer to 12-inch belts is a 12-inch belt or its equivalent, and if to this combination of guns and armor the enemy's ships add the feature of high speed, we must match it with high speed.

It is this trinity of elements that makes up the armored cruiser, and it is just because Spain happens to have and we happen to be without any members of this type that, in spite of our naval superiority, we may be unable to strike the decisive blow by getting rid of the "fleet in being" for some time to come. It is, of course, possible that, before these lines are published, the Spanish admiral may have elected to give battle, or, by skillful strategy upon the part of our fleets, have been so hemmed in as to be forced to fight.

Whatever may be the issue, the situation has already proved that our lack of armored cruisers presents a weak point in the make-up of our navy; one that has already caused us not a little apprehension as to our ability to maintain the blockade, and that may result in the naval campaign being drawn out to an unexpected length. The composition of our navy was determined with a view to coast defense and in agreement with a national policy into which never entered the thought of blockading islands and hunting down hostile armored fleets upon the high seas. We can do nothing to remedy the matter as it stands; but it is in our power to provide against the future by the immediate authorization of several armored cruisers in a supplementary naval appropriation bill.

AIR MOTORS FOR STREET RAILWAY TRACTION.

An important street railway plant, whose operation will be watched with considerable interest, is about to be installed in this city on a portion of the lines of the Metropolitan Street Railway Company. It will be remembered that a few miles of this company's extensive lines have been operated for some time by compressed air motors, which are of the compound type and built under the Hoadley patents. On another stretch of road in this city the Hardie compressed air motor has been in successful operation. The distinctive feature of the Hardie motor is the use of a tank of hot water to heat the compressed air before it is used in the cylinders. A fully illustrated description of this machine will be found in the SCIENTIFIC AMERICAN for August 15, 1896, where it is shown in service on the lines of the Third Avenue Railway Company, New York; another motor of the same type built for the elevated roads was illustrated in the SCIENTIFIC AMERICAN of January 30, 1897.

The new plant will include a power house on the property of the Metropolitan Company in West Twenty-third Street opposite the Pennsylvania terminal, and in addition to the power house the contract calls for the equipment of twenty cars with compressed air. The air compressor will be of the Ingersoll-Sergeant four-stage single-acting type, provided with intercoolers between each pair of cylinders and a final cooler after the fourth-stage cylinder. The air cylinders will be vertical and will be set under a vertical cross-compound Allis engine.

It is interesting to note that the American Air Power Company, to whom the contract has been let, was formed by a combination of the Hoadley-Knight and Hardie Companies. The new plant and equipment will embody the experience gained by the two experimental lines to which reference has been made above, and as both of these tests have shown satisfactory results, it is safe to say that the new Twenty-eighth and Twenty-ninth Streets equipment will represent the very latest advance in compressed air traction. The Metropolitan Street Railway Company has now in operation four different systems: the cable, underground trolley, compressed air and the horse car. The probabilities are that of these four, two only will survive—the underground trolley and compressed air; the former being used on what might be called the trunk lines running north and south on Manhattan Island, and the compressed air motors working the crosstown branches.

LAUNCH OF THE BATTLESHIP "ALABAMA."

The first-class battleship "Alabama" was successfully launched at the Cramps' shipyard on May 18 in the presence of less than one hundred invited guests. The work of cutting away the blocks that held the ship in place was commenced at half past twelve, and the "Alabama" took the water in less than half an hour.

We have so recently described this vessel (see SPECIAL NAVY SUPPLEMENT) that it will be sufficient to recapitulate the leading features of her design, which are as follows: Length on load water line, 368 feet; beam, 72 feet 5 inches; mean draught, 23 feet 6 inches; displacement, 11,525 tons. Her maximum coal supply will be 1,200 tons, and she will be driven at a speed of 16 knots by twin vertical triple expansion engines of 10,000 horse power. This result will be obtained under a moderate forced draught. She will carry a complement of 489.

The armor will be of the latest Harveyized nickel steel and will be more complete than in any ship of our navy. The belt will be 16½ inches thick amidships, tapering toward the ends. Above this will be a wall of 5½ and 6-inch armor protecting the rapid-fire battery. The main battery of four 13-inch guns will be placed in 15-inch turrets above 17-inch barbettes, and the rapid-fire battery of fourteen 6-inch guns will be sheltered behind six inches of steel. The secondary rapid-fire battery will consist of sixteen 6-pounders, four 1-pounders and one Colt. The maximum concentration of fire dead ahead will be two 13-inch and two 6-inch guns; astern it will be the same, and on the broadside the concentration will be four 13-inch and seven 6-inch.

Our readers who are familiar with the details of our earlier battleships will notice that the 8-inch gun which forms such a conspicuous feature in the "Indiana," "Iowa" and "Kentucky" types has disappeared altogether in the "Alabama." This is in accordance with the latest theory or fashion in battleship design, which is to have only three main types of guns: the armor-piercers, generally not less than 13-inch; the rapid-fire battery, of not less than 5-inch caliber; and the secondary rapid-fire battery, of 6 and 1-pounders. The first type is for the penetration of the belt armor and demolishing of the barbettes and turrets, the second type is intended for wrecking the lighter armor, 8 inches or less in thickness, and the "pounder" guns are for the destruction of torpedo boats and the attack of unprotected gun positions. The 8-inch gun has been thrown out because it is heavier than necessary for the attack of light armor and not powerful enough to penetrate belts and barbettes, except at close range.

The long caliber 6-inch rapid-firer can pierce almost as thick armor at the shorter ranges as the 8-inch, and its rapidity of fire is four or five times as great.

Although the "Alabama" is afloat, she will not be commissioned for eighteen months, unless the work is pushed along much faster than is usual on our battleships. If there is no delay waiting for armor, guns, etc., this fine vessel might be in the fighting line by the summer of 1899.

THE HEAVENS IN JUNE.

BY GARRETT P. SERVISS.

At 9 P. M. in the middle of June the great star Arcturus is overhead. Even for those who know and care but little about astronomy it is worth while to look carefully at Arcturus, because Arcturus is the very mightiest sun that the heavens are known to contain. Its distance is about a thousand millions of millions of miles, or more than ten million times the distance of our own sun. Since the intensity of light decreases as the square of the distance increases, it is easy to show that if we were as near to Arcturus as we are to the sun, the earth would be vaporized by the blast of unimaginable heat which would smite it, for Arcturus must exceed the sun in light and heat giving power in the ratio of six thousand to one! As to the actual size of Arcturus, it is not improbable that its globe would more than fill the entire space that is belted by the orbit of the planet Mercury! Not to know Arcturus, then, is to be unacquainted with the most stupendous physical phenomenon within the range of human vision.

An easy way to make certain of the identification of Arcturus is this: Look for the Great Dipper, which will be found between the pole and the zenith, with its handle upward. Follow with the eye the bending line of the handle, beginning at the bowl, and continue it, beyond the last star in the end, to a distance about equal to the entire length of the Dipper, and thus the eye will be led to a bright yellowish star, which is Arcturus. Far southward shines the white star Spica, in Virgo, and farther west the planet Jupiter, the three—Arcturus, Spica and Jupiter—marking the corners of a large triangle.

Northeast of Arcturus will be seen the beautiful circlet of the Northern Crown, and half way between the Crown and the horizon, the brilliant Vega will catch the eye. This star ranks next to Arcturus among the recognized giants of starry space. Its distance is more than five hundred millions of millions of miles, and in light-giving power it probably exceeds the sun about two thousand times! Those who have telescopes may enjoy an exceedingly beautiful contrast of color by looking alternately at Arcturus and Vega.

THE PLANETS.

Mercury is a morning star, visible to early risers at the beginning of the month, but lost in the rays of the sun at the end. It passes from Aries into Gemini, to become an evening star in July.

Venus is beginning to overmatch Jupiter in splendor as an evening star. At the opening of June she is in Gemini and at the close in Cancer. With a telescope she appears in the form of a gibbous moon, more than eight-tenths of her disk being illuminated. Venus is a kind of mirror to the earth. Being very nearly of the same size as our planet, she presents an appearance similar to that which the earth would present if we could look at it from a corresponding point of view. But when, as will happen in December, Venus comes between the sun and the earth, her inhabitants will behold a planetary spectacle more magnificent than any ever presented to our eyes; for then the earth will be seen in their midnight sky, in the phase of a full moon, with all its continents, and oceans, and streaming storm clouds plainly visible to their telescopes; and accompanied by its ever faithful attendant the moon, which itself will appear as a planet of no mean size. Its cloudless condition, in contrast with the earth, would instantly arrest the attention of an astronomer on Venus.

Mars in these warlike days sulks in his tent. He is far off and faint in the morning sky, passing during the month from Pisces into Aries.

But while the celestial god of war thus apparently neglects his interests on the earth, the great master planet Jupiter occupies a commanding place, crossing the meridian early in the evening and remaining conspicuous during the first half of the night. Jupiter has developed a remarkable series of dark elliptical spots in his north tropical zone during the past two years, and at present these spots appear to be increasing in number. Three of them are being carefully studied by observers of Jupiter, and their velocity of motion is said to be greater than that of spots which were seen in the same latitude three or four years ago. The commotion of Jupiter's surface markings is always a fascinating thing to watch. Tremendous changes are evidently going on there, but the clew to their nature is yet lacking. Jupiter is in the western part of Virgo, moving slowly toward the southeast.

Saturn, near the northern edge of Scorpio, rises about 7 o'clock in the evening on the 1st of June, and crosses the meridian about midnight, having been in opposition to the sun on May 30th. Its north pole and the northern side of its rings are presented toward the earth. Its most conspicuous satellite, Titan, will be seen at eastern elongation on June 8, at western elongation on June 16, and at eastern elongation again on June 24.

Uranus remains in Scorpio, and during the month retreats slowly westward from the neighborhood of the double star Beta.

Neptune is in Taurus, and in conjunction with the sun on the morning of the 13th.

THE MOON.

The moon is full on June 4; at last quarter on June 11; new on June 18, and at first quarter on June 26. It is nearest to the earth on the 19th and farthest from the earth on the 4th. Greatest libration east, June 27; greatest libration west, June 11.

The lunar conjunctions with the planets occur as follows: Uranus, the 3d; Saturn, the 4th; Mars, the 14th; Mercury, the 17th; Neptune, the 19th; Venus, the 21st; Jupiter, the 26th.

On the morning of June 21, about 5 o'clock, Eastern standard time, the sun enters the sign Libra and the astronomical summer begins. Eleven days later the earth will be at the cooler extremity of its orbit, or in aphelion, a fact which those who find comfort in the reflection that things might, at any time, be worse than they are, will do well to recollect when July rolls in its tide of heat.

SAN JUAN'S BOMBARDMENT.

In our last week's issue we referred to the bombardment of the fortifications of San Juan, the capital of Porto Rico, on May 12. At that time only meager details of the engagement were available. Now, however, full particulars of the battle have been published. As will be seen by our plan of the harbor of San Juan, the reef on which the city is built is practically an island separated from the mainland by a tidal ditch. The whole sea front of the island is precipitous, especially so at the western point, where rocks frown above the entrance to the bay within. At this spot stands the old stone fort called Morro Castle, with its thick walls and tiers of guns. It was in the time of smooth-bore guns practically impregnable. Having fears of buccaneers in the old days, the Spaniards erected a defense line running along the shore front for three-quarters of a mile, where they built another big castle. The defense line was carried all the way around the inner front of the island or peninsula, and within this area they built the town.

When the fleet approached the lighthouse tower, 171 feet above the sea, it did not show any light, indicating that the people of the town were expecting trouble. The "Detroit" with the tug "Wampatuck" slowly led the way in. The torpedo boat "Porter" ran off to the east a half mile or so from the line of the squadron and stopped within a mile of the shore. On arriving within 1,400 yards of Morro Castle the "Detroit" turned west and steamed slowly along the beach for a quarter of a mile, while the "Wampatuck" with her flag of truce drifted on, followed by the "Iowa," the "Indiana," "New York," "Amphitrite" and "Terror." It was at five o'clock that the "Detroit" turned east, and at that moment a signal fluttered on the "Iowa" which called for the hoisting of the American ensign on every ship. For six minutes the flags floated in peace, and then some Spanish officer having no regard for the flag of truce opened fire on the "Wampatuck" and sent her skurrying away out of range. Admiral Sampson told Captain Evans that the fire might be returned. The forward turret of the "Iowa" was turned so that the long 12-inch rifles were headed at the yellowish walls of the old castle, and at 5:15 o'clock the word "fire" was given, and the huge projectiles were hurled at the point whence the guns had been firing at the flag of truce. The aim was so good that no further shots were fired from that part of Morro during the remainder of the engagement. The 8-inch guns then took part, and the "Detroit" followed with her 5-inch guns. Then came the "Indiana" with her 13-inch rifles which took the place of the flagship, which was steaming slowly out to sea, her 8-inch guns also firing. The fleet was now steaming slowly in a circle.

In the meantime the soldiers in all the forts had begun to fire on the squadron, but it was a useless task, for the shots from the old smooth-bore guns did not reach the vessels. At first the fire was so feeble that it is thought that the artillerymen were enjoying a peaceful rest when they were rudely awakened by the roar of the big guns. At Santo Domingo barracks there was a battery with at least four modern rifles of 8 or 10-inch caliber and other batteries appeared to be equipped with modern guns. These opened on the fleet soon after the first gun was fired from Morro, but not since modern rifles with gun sights were invented has any one seen such shots as from these crest batteries. Shot after shot, mounting into hundreds, were fired, but hit nothing, every shot flying far above and beyond the great targets. Even the unarmored "Detroit," which lay perhaps 1,200 yards from the nearest battery, remained wholly untouched. The Spaniards did not neglect the "Porter," and she would have been an easy prey if they could have hit her, but their efforts were futile. The marksmanship of the American squadron on the first round was not, on the whole, quite worthy of the record made at the targets. The majority of the shots hit Morro, but three or four at least fell so far short as to strike the water, but the first round of the squadron in its elliptical course cured that completely. The Spaniards, as the "Iowa" came down on them for the second round, worked their guns with increased frenzy and their aim was worse and worse, until the "Iowa" reached the turning point and once more began firing with her 12-inch rifles, the "Indiana" following. The Americans now had perfect range and were as cool as at target practice, while the Spaniards shot wilder and wilder and at last fled. The first shot which seemed to reach the city struck the huge barracks just east of Morro. A cloud of yellow brickdust rose high in the air, obscuring the building, and the flames and smoke of a conflagration appeared. Within ten minutes a half dozen other shots had fallen elsewhere in the town, and by the time the "New York" turned out to sea again seven different fires were seen in different parts of the city.

The forts nearest Morro were wholly obscured by the smoke of the shells. The forts replied with an occasional gun, and most of the Spanish at this time had fled to the bombproofs. The guns at the east of the city, however, continued to work steadily because they had received little attention from the ships. The "Detroit" now turned to the west, and running close under the guns of Morro, attacked a new earthwork built on an island on the west side of the channel. There were a couple of modern 8-inch guns there, but the little vessel forced the gunners to retire. Both the "Montgomery" and the "Porter" were ordered out of range, but a casual observer would say there were no cases on record during the cruise where orders were obeyed with such deliberation.

Three circuits were made. The first gun, as has been said, was fired at the forts at 5:15 A. M., and at 7:20 A. M. the "Iowa" opened fire for the third and last time. Before her guns were fired a big breach was plainly visible in the curtain wall of Morro, and from that time on, nothing of the fort could be seen because of the smoke and dust. The "Indiana" began the last round at 7:26 o'clock, the "New York" at 7:30, the "Amphitrite" at 7:40 and the "Terror" at 7:50.

The big fort east of the city near the Tierra gate was hit as the "Iowa" turned away, firing her last shot. Five guns had been worked steadily from within the fort, but only two were fired after that and they quit soon after the "New York" got a broadside on the city, but they opened again after she pulled out and then one shot from the hill battery just east of Morro was fired. It struck against the iron stanchions used for hoisting the boats to and from the superstructure of the "New York" and burst.

The boat was knocked to pieces, and a fragment of the shell struck Frank Widemark, seaman, and he was killed; three or four others were injured. A 10-inch shell struck a gallows frame on the "Iowa" and burst at about the same time, hurling fragments in all directions; three men were injured. Both these shots were plainly accidental because they came on board at long range and because the following shots fell as wide as usual of the ships. As the squadron drew off, the "Terror" lingered behind, firing at five minute intervals, until 8:05 o'clock, when the last shots from the fleet were sent. The hill battery kept wasting its ammunition until 8:29.

The admiral and all the officers, save only those stationed under cover, fought on the bridge and upon the decks. Admiral Sampson went from point to point on the bridge or deck as the exigencies of the smoke made it convenient. Though the battle may be considered as an unimportant incident of the war, like the bombardment at Matanzas, it certainly proved the lack of training of the Spanish and demonstrated the skill and ability of the Americans. The destruction in the town was not great, but nearly all of the big guns were dismounted.

STATE COLLEGE OF FORESTRY.

A conference has been held at Albany to decide upon the location of 30,000 acres of land to be purchased by the State for the establishment of a college of forestry under the authorization of an act of the last legislature. Dr. Fernow, director of the new State College of Forestry at Cornell University, who was formerly chief of the Forestry Division of the Department of Agriculture at Washington, formulated the conditions which the Cornell authorities had decided necessary for land for the purpose of the new college, and a canvass was made of the available property in the Adirondack woods which is on the market. This developed that there were not more than three or four tracts available, which it is believed the State could readily secure. These tracts are in Hamilton and Franklin Counties, and it is held that they could be purchased at less than $6 an acre. No particular plot of ground has been decided upon as yet.

SOME INTERESTING FEATURES OF THE ELECTRICAL EXHIBITION.

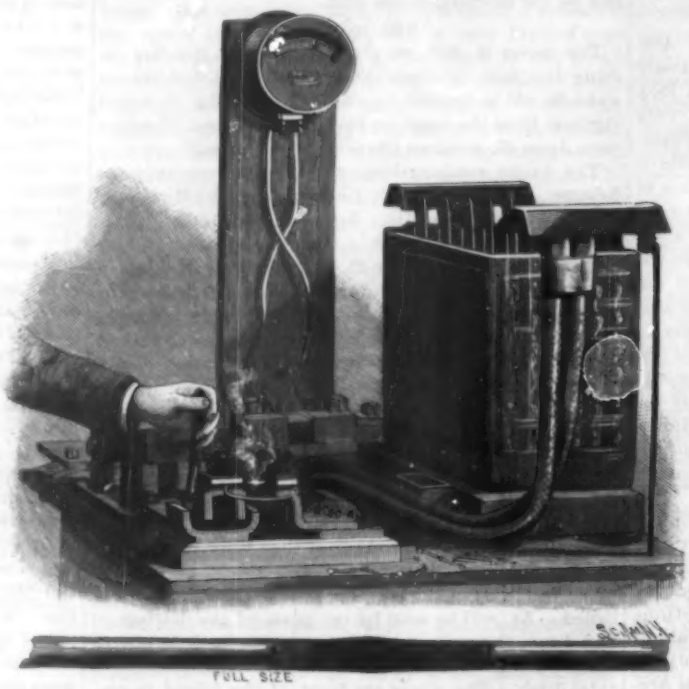
Not long since we illustrated a new system of wireless telegraphy, designed by Mr. E. J. Clarke, of the United States Electrical Supply Company, of this city. Since then the system has been improved in many ways, and he is now giving an exhibition at the Electrical Show in the Madison Square Garden which is attracting a great deal of attention.

In a showcase in the center of the south gallery is placed an automatic transmitter, which is insulated. A storage battery of four cells is placed in the lower part of the case, which feeds the primary of a 4-inch spark coil, the current from the battery first passing through an automatic circuit breaker (not shown). This automatic circuit breaker does not take the place of the vibrator of the coil (that being provided as usual), but is so arranged that it will make and break the circuit in the same manner as a telegraph operator would when manipulating his Morse key in the act of calling N. Y. N. Y. N. Y., which is the well known telegraph call for New York City. In this way it will be seen that the sparks from the secondary of the coil are intermittent, and their duration is governed by the length of the time during which the automatic circuit breaker allows the circuit to be closed while making the dots and dashes. Immediately in front of the induction coil is placed the improved oscillator, which consists of two solid brass balls about four inches in diameter, as shown at 2 in our illustration, mounted so that the distance between them is adjustable. Outside these balls are placed two smaller balls about an inch and a half in diameter attached to sliding brass rods, on the outer end of which are other balls one inch in diameter, so that the distance between the large and the small balls can be easily adjusted. The secondary terminals of the coil are connected to binding posts on the base of the oscillator which connect direct with the brass standards that serve as supports for the sliding brass rods. The distance between the balls being properly adjusted and the current turned on from the battery, the sound of the secondary sparks passing between the balls can quite easily be recognized as the dots and dashes of the signal N. Y. So apparent is this that telegraph operators visiting the exposition are immediately attracted by the sound. One terminal of the oscillator is connected to earth and the other to a brass rod about ten feet in length placed on top of the showcase.

In the center of the north gallery directly opposite and about 200 feet distant is placed the receiver, which consists of a Clarke coherer relay and receiving instrument constructed almost precisely in the manner described in our issue of April 2, with the exception that a large six-inch vibrating bell is connected up in the local circuit in addition to the telegraph sounder. This six-inch bell is continually ringing out the Morse signals N. Y. N. Y. N. Y., and by holding down the hammer of the bell the sounder can be distinctly heard repeating the same call. Considerable trouble has been experienced in overcoming the effects of self-induction in this apparatus, but now it is claimed the difficulty has been overcome.

In the center of the garden is placed a large tank of water, and four times each day a miniature warship about three feet in length is placed in this tank, and floated over a submarine mine, which is connected to a coherer, relay and battery placed immediately outside of the tank in the manner shown at 3 in our engraving (the coherer tube being shown enlarged at 1). One terminal of the coherer is connected to earth, and the other to an insulated wire rising about ten feet in the air. When the time comes for exploding the mine under the warship, the oscillator in the south gallery is stopped and connection made at the tank between the coherer and the vibrating bell which is used for testing purposes. The oscillator is now started for an instant to see if the bell at the tank rings, thus proving that the coherer is in proper adjustment. The bell is now disconnected, and connection made to the submarine mine instead, and at a signal from the attendant the man at the transmitter again presses the button, which throws the current into the oscillator, the coherer completes the local circuit and the mine instantly explodes, breaking the warship into splinters, and throwing it and the water high in the air. Of course it is understood that the mine is provided with an ordinary electric fuse. The apparatus at the tank is placed on the outside, so that visitors to the exposition can readily understand the arrangements, but that is not necessary in any way, as Mr. Clarke is prepared to blow up mines in this way with all the apparatus contained in a waterproof box connected directly to the mine.

We understand a carefully insulated wire has been run from the transmitter to the highest point of the tower of the garden, and that during the next few days it is intended to send messages many miles from the city.



FULL SIZE

ELECTRIC WELDING BY MEANS OF AN ACCUMULATOR, AND A SAMPLE OF WORK.

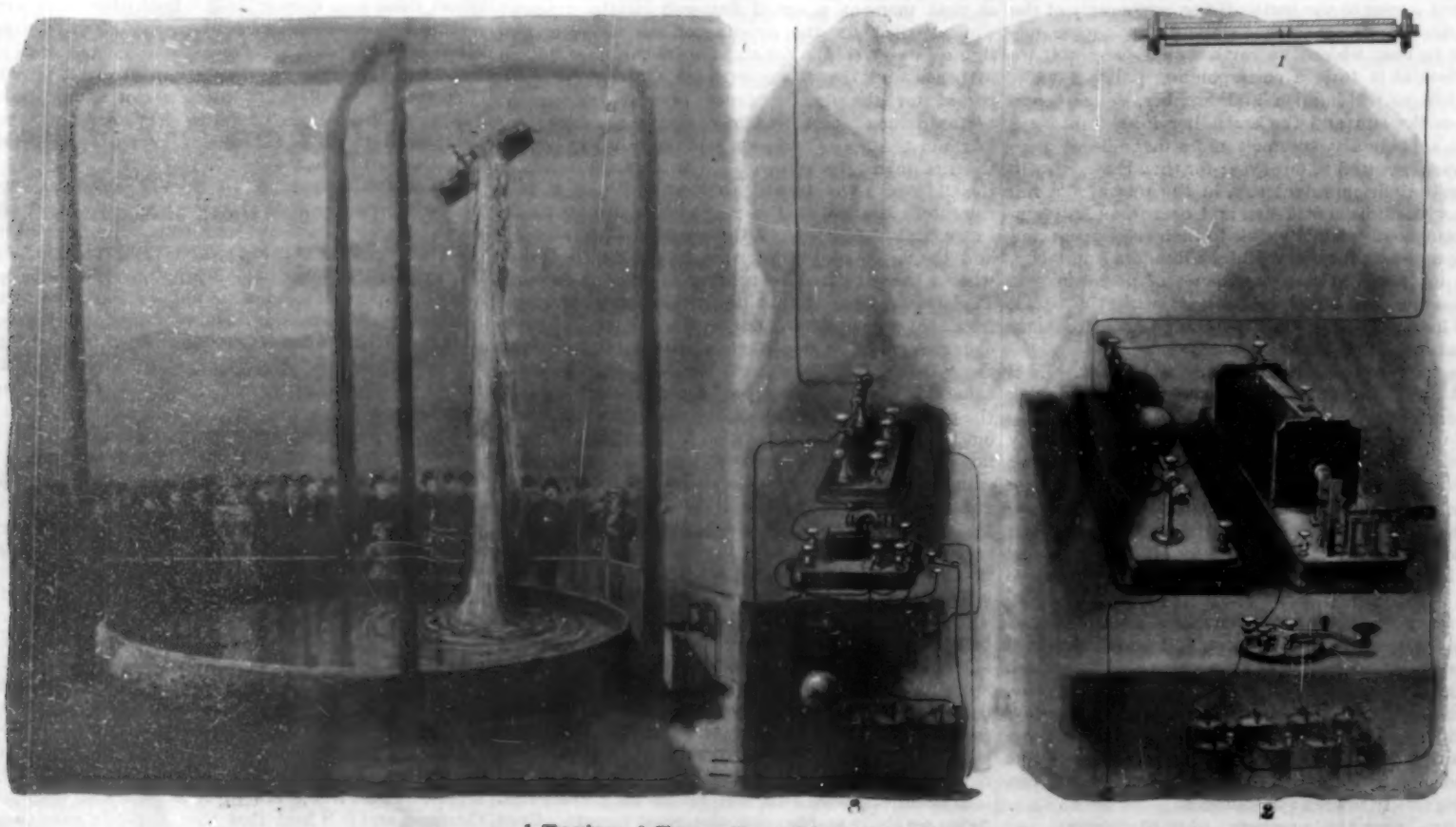
Among the interesting things to be seen at the Electrical Exhibition, now in progress, is the electrical welding outfit shown by the Electric Storage Battery Company, of Philadelphia and New York. The welding is done by one chloride accumulator element known as type F-11, consisting of eleven plates, each 10⅛ by 10⅛ inches. These plates are immersed in dilute sulphuric acid in a glass jar resting upon an insulated tray filled with sand. At the side of the cell, and connected to it through heavy cables, is a copper clamp, one jaw of which moves on a sliding contact. The metal to be welded is gripped in the clamps, and when brought to the proper heat, is forced together by means of the movable jaw. The usual method of the exhibition is to place a solid bar in the clamps, heat it to the melting point, break it by means of the sliding jaw, and then weld it. The power required depends upon the size of the bar operated upon.

The bars generally used take 800 amperes for a few seconds and the current then drops to 400 amperes, at which point the weld is completed. The cell operates at 2 volts, and the power required is, therefore, from 1·6 kilowatts to 0·8 kilowatt. The normal discharge rate of the cell is 50 amperes. The outside dimensions of the glass jar are 10¼ inches by 12¼ inches long by 15⅛ inches high.

This outfit appears to be a very desirable one for the smaller welds required in many branches of manufacture. A very interesting souvenir furnished to visitors consists of two wire nails welded together at the point, as shown in the small detail figure.

Training the Sight.

Mr. R. Brudenell Carter, F.R.C.S., in a lecture before the London Society of Arts, directs attention to the fact that acuteness of vision may be increased by training. He suggests that the average acuter vision of country over town children is due to the fact that the latter see chiefly large objects and under large visual angles, while the former are habitually attending to smaller and more distant objects, seen at smaller angles. He suggests, therefore, that school teachers should be instructed to test the vision of new pupils and record the same in a register, informing the parents of any defects observed.—Medical Times.

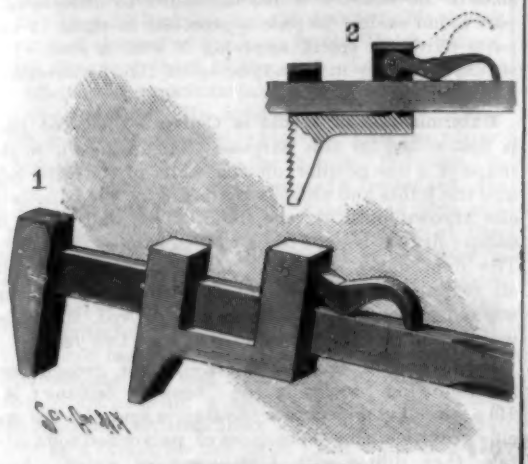


1. The coherer. 2. The transmitter. 3. Relay and testing bell.

EXPLOSION OF A SUBMARINE MINE BY ELECTRICAL WAVES FROM TRANSMITTER USED IN WIRELESS TELEGRAPHY.

AN IMPROVED WRENCH.

The simple, readily adjusted wrench shown in our illustrations consists of a fixed jaw with a plain rectangular shank upon which a sliding jaw moves. Two strap extensions on the sliding jaw embrace the shank of the fixed jaw, and a spur on the sliding jaw serves as a fulcrum and gripping surface. In connection with the sliding jaw, a grip lever is employed provided with an angular head for engagement with the shank of the fixed jaw at a point opposite to the previously mentioned spur. In operation, after the grip lever has



HENWOOD'S WRENCH.

been raised to disengage the angular head from the shank, the sliding jaw is adjusted to the desired position and the grip lever then carried forward, thus bringing the sharp-pointed angular head into contact with the shank. At first a rocking of the jaw on its spur takes place, and upon continued movement of the lever, the jaw will be locked in fixed position. The greater the resistance encountered in operating the wrench, the greater will be the binding action of the lever. Referring to our illustrations, it will be seen that the surfaces of the jaws may be either plane or toothed, according as it is desired to use the wrench for nuts or pipes. The wrench is the invention of Edwin Henwood, of Hancock, Mich.

A NOVEL TWINE HOLDER.

An invention which is an improvement upon that form of twine-holding devices in which means are provided whereby a certain amount of the free end of the string is retracted, has been patented by Frederick W. Copcutt, of No. 234 Stuyvesant Avenue, Brooklyn, N. Y. Referring to our illustration, it will be seen that the moving parts of the device are mounted on a frame consisting of a board or back plate provided at top and bottom with projecting ledges. Near the upper end of the board a clamping lever is pivoted, secured to one end of which is a cord guide. The other end of the lever is provided with a plate adapted to engage with a stop fixed to the under side of the upper ledge. An inclosure on the lower shelf contains the ball of twine. Adjacent to that end of the lever carrying the cord guide and connecting the upper and lower ledges

COPCUTT'S IMPROVED TWINE HOLDER.

are two guide wires, which are embraced by two side extending arms attached to a sliding weight. The upper end of the weight is provided with upwardly extending arms, to one of which a pulley is journaled. The other arm may be swung aside so as to permit the cord to be placed conveniently around the pulley. The manner in which the cord is rove through the several guides and pulley will be clear from the drawing. In using the twine holder, when the free end of the cord is pulled down, the vertically sliding weight is first raised until the pulley is nearly upon a level with the adjacent end of the lever. At this point the weight to a large degree ceases to act upon the lever, which then relaxes its binding or clamping action on the cord. When, after use, the free end of the cord is released, it is carried upward by the falling of the weight. The back board is of a size large enough to receive advertisements, to which the attention would be directed, owing to the novelty of the mechanism.

The Wellman Polar Expedition.

Mr. Walter Wellman, the correspondent and explorer, has sailed for Europe. He will go to London and then to Norway, from whence he expects to start northward about June 20. His point of departure will be Tromsoe, on the northern coast of Norway. From Tromsoe he will go to Archangel, Russia, where a pack of Arctic dogs are awaiting him. From Archangel the expedition will sail through the floating ice to Cape Flora, in Franz-Josef Land, where he expects to establish a supply station. The explorers will then push on to the north end of Franz-Josef Land. They will winter somewhere between 82° and 83° north latitude, in a hut built of stone, drift wood, walrus skins and ice, living on the game of the country, which is said to be very abundant. Before the middle of February the long Arctic night will be over and the dawn will be light enough to permit of further travel. Mr. Wellman has allowed himself about sixteen weeks between February and June for his journey of 1,000 miles between his winter stations and the pole and back again. He has not dared to allow himself a longer period, because soon after the first of June the snow in that region begins to melt enough to make travel through it extremely hard. Allowing an average of nine hours' travel every day for 112 days, the party could make one mile an hour and accomplish their round trip between their winter stations and the pole with a little time to spare, but with all their supplies carried by dogs, sleds and by themselves on skii they will be able to make much better progress than this and allow liberally for all sorts of delays and for a sufficient stop at the pole, if they are fortunate enough to reach it, to make valuable observations. Mr. Wellman has decided to devote a year and a half to his expedition, and whether he finds the pole or not, he feels he may bring home news of the fate of the explorer Andrée. Mr. Wellman has been forced reluctantly to believe that Andrée has perished. Celebrated explorers, including Dr. Nansen, have spoken very favorably of Mr. Wellman's plans. Prince Luigi has adopted the same route for his own expedition, which is to start in 1899. Mr. Wellman's ship will be the "Frithjof." The members of the expedition will consist of Prof. Harlan, of Columbian University, who will be the physicist of the party under the auspices of the United States Coast Survey; Lieut. Baldwin, of the Weather Bureau, who will serve as mineralogist, botanist and geologist; and Dr. E. Hofma, of Grand Haven, Mich., who will act as medical officer and naturalist. Mr. Wellman will be the leader and director of the entire expedition. He has selected Norwegians instead of Esquimaux to accompany his party, as experience has proved to him that the Norwegians are more hardy and understand traveling through the frozen zone in all its technical details quite as well as the Esquimaux and have vastly greater courage, intelligence and persistence.

Prizes for Railway Inventions.

The German Railroad Union (Berlin), says The Railway Gazette, has every four years offered prizes for inventions and improvements in railroad construction and machinery and railroad management. This spring it announces a first prize of $1,800, a second prize of $720 and a third prize of $360 for inventions and improvements in construction and mechanical apparatus; equal prizes for inventions and improvements affecting rolling stock and its maintenance; and a first prize of $720 and two prizes of $360 each for improvements in administration and operation. Without excluding other things, the union suggests as matters in which improvement is desired:

Improvements in the construction of locomotive boilers, especially such as, without increasing weight materially, secure economy in fuel, the prevention of sparks, the most complete consumption of smoke possible, and the reduction of cost of maintenance.

An arrangement by which the coupling of cars with automatic American couplers and those with the standard couplers of the times may be made without danger.

Weighing apparatus by which separate cars while moving or loosely coupled cars of a whole train may be weighed with sufficient accuracy.

Some means of protecting a train which has come to a stop or is threatened with delays which in bad weather and at night will work better than the track torpedoes and the hand signals of track and train men.

Those inventions or publications alone may compete which have been made or published between July 15, 1891, and July 15, 1899. The invention or method must be already introduced on some railroad in the Railroad Union, before application is made to compete, and its application must be supported by the railroad trying it. Notice of competition must be sent in to the executive of the union between January 1 and July 15, 1899.

AN EFFICIENT FEED MIXER.

A feed mixer has recently been patented by Walter G. Pearson, of Newburyport, Mass., which is designed to mix feed without kneading it. In this feed mixer a shaft is mounted in a frame, and a cylinder is axially mounted on the shaft so that its walls will be concentric with the shaft. Connected by their central portions to the shaft are a series of arms so arranged that their ends shall be in proximity to the inner sides of the chamber. The end portion of each arm has its sides beveled in opposite directions so as to cause a portion of the material to be thrown by one side of the

PEARSON'S FEED MIXER.

arm in one direction, and a second portion of the material to be thrown by the other side of the arm in an opposite direction. Upon the ends of the arms knives are carried which lie flat against the inner sides of the chamber so as to scrape away the feed. When using the apparatus, the feed is inserted through an orifice on the top, and the chamber is held with the orifice uppermost during the period in which the shaft is revolved to mix the feed. When the mixing operation has been completed, the chamber is permitted to turn one-half a revolution so as to throw the orifice downwardly and permit the discharge of the contents.

A NEW CLOTHES HANGER.

A clothes hanger designed to facilitate the hanging of clothes without danger from windows has been patented by Richard B. Fordham, of Rahway, New Jersey. As will be seen from our illustration, a bracket is pivoted to the outer wall of a building adjacent to a window, and is of such length as to enable its free end to be readily swung inward to the center of the window. A cross piece at the free end of the bracket is provided with pulleys. Around these and around pulleys attached to a pole or other distant support an endless clothes line passes, as in ordinary clothes line contrivances. To the middle part of the bracket are attached the ends of two cords for swinging the bracket to and from the window, the ends of which are to be passed into the window and secured to a free cleat or the like. One cord is passed around a pulley whose block is attached to the wall at a distance from the window so that the bracket can be swung outwardly away from the window by pulling upon the cord. By pulling upon the other cord the bracket can be swung inwardly into position for use. This arrangement permits the line to be placed conveniently for receiving or removing clothes without danger of a person falling from the window and yet places the devices out of the way when filled or not in use.

The clothes lines are attached to the pole or other support by means of spiral springs interposed between the pole and pulley blocks. Hence, when the line contracts during wet weather or the bracket is swung in toward the window, the elastic connection at the pole will yield, and when the line dries out and lengthens, the elastic connection will take up the slack.

FORDHAM'S WINDOW CLOTHES HANGER.

Correspondence.

EFFLORESCENCE AND OXIDATION OF SODIUM SULPHITE.

To the Editor of the SCIENTIFIC AMERICAN:

I inclose the different results that were obtained here in the laboratory on the efflorescence and oxidation of sodium sulphite.

These results were obtained by taking ordinary commercial sulphite and grinding it to a coarse powder, and then spreading it in a layer of a quarter of an inch on a glass plate protected from dust.

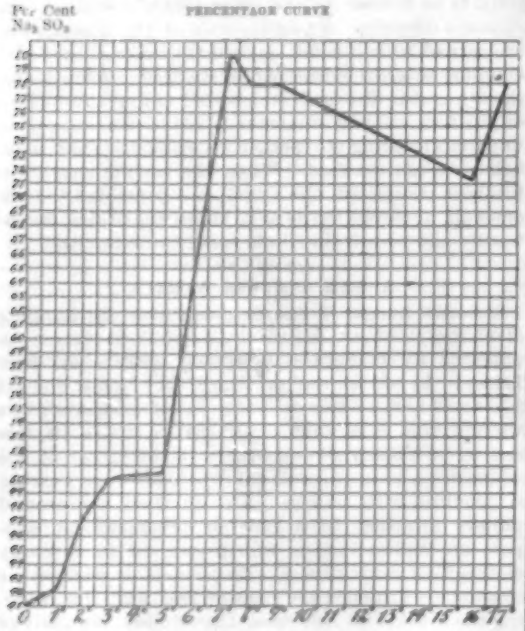
At the end of the first day a sample was taken and weighed, then dissolved in a beaker with some water and titrated with $\frac{N}{10}$ iodine which had been standardized before. A burette of 50 c. c. capacity was filled with the standard iodine solution. Everything now being ready, the iodine was run in on the sulphite, starch indicator being added beforehand, when the blue color of starch iodide made its appearance, this being shown by the last drop of iodine producing a deep blue coloration, the stop cock was shut off and the number of c. c. used read off.

The calculations were very simple, being based on this reaction:

$$\underbrace{Na_2SO_3.7H_2O}_{20)251{\cdot}6} + \underbrace{I_2}_{20)254} = 2NaI + H_2SO_4 + 6H_2O$$

$12{\cdot}58$ $12{\cdot}7$ = grm. in 1000 c. c. of standard solution.

The results from the analysis are all combined in the form of a table or curve seen in the illustration.



EFFLORESCENCE AND OXIDATION OF SODIUM SULPHITE.

When the sulphite was first exposed its per cent was 41. The first day of exposure the sulphite lost water enough to reach 43 per cent real sulphite, next day it jumped to 48 per cent, and so on until it reached 80 per cent. It was evidently at this point that all the water had been lost by efflorescence. Then oxidation started and oxygen was taken up from the air to lower the percentage of real sulphite down to 71¼ per cent, but here, again, the loss of some more water was sufficient to overcome the loss by oxidation and run the percentage up to 78, but this would only be a temporary gain, as oxidation would begin to lower it.

RANDOLPH BOLLING.

Chemical Laboratory, University of Virginia.

A Solar Magnetic Engine.

To the Editor of the SCIENTIFIC AMERICAN:

I find your paper here on the table, and in looking over it is revived the memory of 1845, when at Philadelphia I first commenced to read it as a system of education in science and invention, in which I had engaged when only eighteen years of age—1840. Born at Philadelphia in 1821, sound and healthy yet, due to my discoveries in medical chemistry. A few days since I was examining several of your papers of 1850, containing a description of my solar magnetic engine, which was a continuous rotary motion derived from the alternating action of horseshoe magnets. I then gave it to the world, through your paper, The Franklin Institute Journal, and London Mechanic's Magazine. Now I ride in the cars here, propelled by its power. I had it running in Philadelphia in 1850, and now the world knows not whence it came. Such is the fate of science and invention when not accompanied by the grasping greed of gain. My prediction that it would become an engine of power to the world has been verified, and that is my satisfaction. I was far ahead of the electric age in 1850 when I made it. I hope some of my old friends of that time among you are still living. WILLIAM WHEELER HUBBELL.

House of Representatives, U. S., Washington, D. C.

The Tomb of Gengis Khan.

M. Bonin, vice-resident of France in Indo-China, has communicated to the Academie des Inscriptions et Belles-Lettres a very interesting note upon the historic monument designated by Mongolian tradition as the tomb of Gengis Khan, and which has often been described by travelers, although no one has up to the present been able to enter it and inspect it in detail. The following is what Prjevalsky, the Russian explorer, has to say of it:

"Legend teaches us that the mortal remains of Gengis Khan repose in the bosom of Ordos, in the district of Wan, which is situated at 200 versts to the south of Lake Dabasoun-Nor. These remains are inclosed in two coffins, one of silver and the other of wood, placed under a tent of yellow silk. The arms of the monarch are near him, and the other members of the royal family are buried at a distance of ten versts further along. A sheep and a horse are offered every evening to the royal manes, and the next morning the offering has disappeared. At his death, the conqueror predicted that he would come to life again in eight or, at the most, ten centuries. Consequently, it will be necessary to wait but a hundred and fifty or three hundred and fifty years for such resurrection. Then a war will break out between Gengis Khan and the sovereign of China. The former will be the conqueror and will lead the Mongolians from Ordos to Khalka, their own country. It has been impossible for me to ascertain the location of the mortuary temple of which this legend speaks."

This passage in Prjevalsky's book attracted M. Bonin's attention, and he conceived the idea of making some researches with a view to discovering the mysterious tomb.

In the month of July, 1896, says he, in the course of an official mission of which I had charge upon the frontiers of China, finding myself on the bank of the Yellow River, to the north of Ordos, in the center of which, according to the concordant narratives of explorers, the tomb ought to be found, I decided to verify the facts set forth in the tradition.

It requires a march of about a week, to the south of the Yellow River, through the territories of the kings of Djoungar and Wan, to reach the monument, which, in Mongolian, bears the name of Yeke-Etjen-Koro, or "the palace of the great lord," and which stands in the center of the desert surrounded by a village of tents. The tomb, which fronts the southeast, has for subbasement a vast platform of stones, and the posterior half is surrounded by a wooden palisade. This latter incloses the two large tents that cover the emperor's remains, and, to the left, a small tent, and, in the rear, a wooden booth where objects of worship are dispensed. It is entered through a gate provided with a shed in the Chinese style.

The two large felt tents that cover the tomb are exactly like the tents of the present Mongolians, but are of much greater dimensions. They are placed back to back, so that, from the first, one can see what is taking place in the second, and each is surmounted with a gilded bronze ball such as may be seen upon the roofs of the large Thibetan lamaseries. The front tent is used for religious exercises, and a dozen men can easily stand erect in it. In the center there is an altar covered with yellow silk, at the sides high red lacquered tables, and at the back a violet silk velum, ornamented with flowers, that seems to be very ancient and dates back, perhaps, to the time of the Conqueror. A red curtain separates the two tents, and is raised only for prayers and sacrifices. When this is drawn, there is seen upon the floor of the second tent the large, low and wide silver coffin, which contains the emperor's remains. It has the form of a huge chest ornamented with rosework chiseled in the metal. At the back of the tent and over the tomb there is a mirror with an inlaid frame of Chinese workmanship, and from the sides are suspended various objects that are said to have belonged to Gengis, especially his saddle and saber. In reality these are reproductions. The originals have been carefully concealed, on account of the sacrilegious thefts that have been attempted at different times, especially during the last Mussulman revolt.

The worship that is rendered to the memory of Gengis Kahn is purely laical. It is performed by officers who are hereditarily in charge of the tomb, and who receive from the court of Pekin regular titles of mandarin order. The external forms of the worship comprise three sorts of ceremonies: the petty sacrifice, the great sacrifice or sacrifice of the horse, and the great commemorative fete that takes place every year on the twenty-first day of the third moon, the anniversary of Gengis' death. On this day the Mongolians come from every part of the desert to pitch their tents at Yeke-Etjen-Koro and venerate the relics of the emperor, which are brought together and exposed around the tomb.

Miscellaneous Notes and Receipts.

To Thaw Out Water Pipes. — According to the Deutsche Hausbesitzer Zeitung, a simple remedy consists in shoveling away the snow from above the pipes, covering them one-quarter meter high with unslaked lime and pouring on water. In consequence of the heat generated thereby the ground and the pipes are thawed out.

Preserving Stone Monuments.—To retard the disintegrating of stone monuments, such as tombstones, etc., without painting them and covering up the natural color of the stone, it is recommended to dissolve one part blond shellac (as pale as possible) in eight to ten parts pyroxylic spirit, applying it with a rose. The shellac dissolves in pyroxylic spirit like in alcohol.—Leipziger Maler Kalender.

Extermination of Mould in Cellars.—Unslaked lime is best suited for this purpose. Same is blown, in the shape of a fine powder, on the walls of the cellar and into the joints and crevices by means of the bellows or else thrown on with the hand. The walls must be damp; dry walls have to be well moistened previously. The lime slakes with the adhering water and kills all organisms. On the day following the walls are washed off, and, as experience has proved, the cellar will remain free from mould for at least two years.

Production of Ground Glass.—Lainer recommends the following process in the Chemiker Zeitung: Mix 240 c. cm. of commercial hydrofluoric acid of 1·258 specific gravity with 600 grammes of pulverized soda crystals, then dilute with 1,000 c. cm. of water. After standing for some time a sediment is formed and over it a clear solution. The thoroughly cleaned glass pane is provided with a wax edge (prepared by kneading yellow wax with tallow, colophony and asphalt powder) and pre-etched with common hydrofluoric acid (1 : 10) for some minutes to obtain an absolutely clean glass surface. Then wash with water and wipe the plate with a clean, soft sponge until the surface is only very slightly moist. Stir up the paste of the etching acid and pour the mass ½ to 1 cm. high upon the pane. With this mixture a nice normal deadening is obtained after one hour. If the acid is old, having been used often, it may be made to act longer upon the plate of glass. The liquid is poured back into the vat and the glass is rinsed off with water. Then the water is allowed to remain upon the pane until a skin, formed from the surface of the glass, can be removed with the finger or a brush. The strong deadening obtained by this method can be fixed to any desired degree of transparency by etching with hydrofluoric acid.

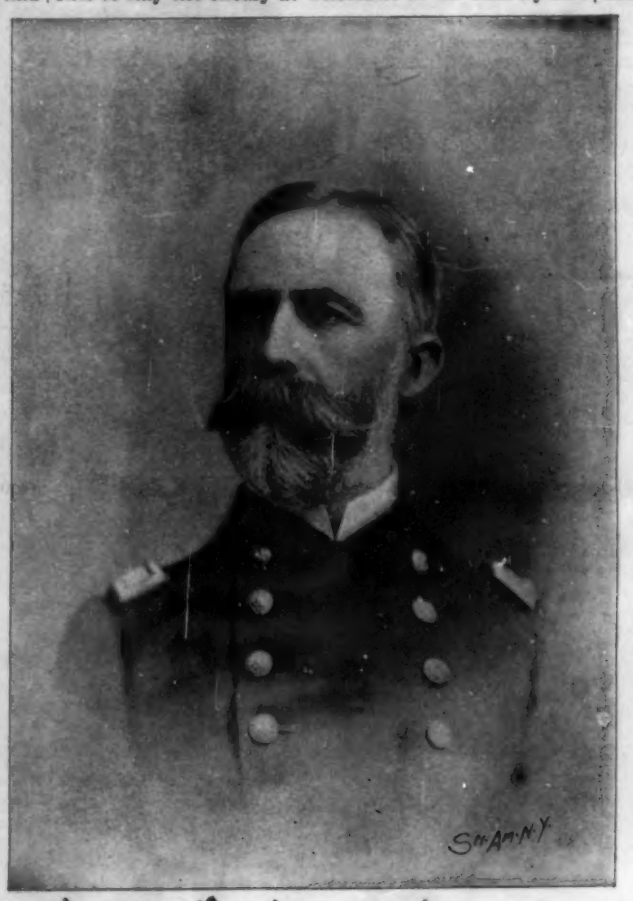
Hardened and Washable Articles of Plaster of Paris.—For the hardening of gypsum a firm in Heidelberg has taken out a German patent on a process which apparently surpasses all those in existence and furnishes very satisfactory results. Either burnt gypsum is prepared and mixed with the liquid named below or else the finished articles of hot gypsum or of mixtures of gypsum and other bodies are impregnated by painting with the fluid. The same consists of a solution of ammonium triborate in water. For this purpose boracic acid is dissolved in warm water and a certain amount of ammonia is added, whereby a substance readily soluble in water and deviating much in its properties from known compounds results. The saturation of the gypsum or painting of the plaster of Paris articles is carried out in the cold. The objects are subsequently rinsed off and dried. The surface becomes very hard after two days and insoluble in water, while the induration in the interior advances more slowly. By means of the fluid described gypsum floors can be hardened and rendered more durable and impervious to the influence of the weather. Saturating with ammonium borate is said to be especially useful on exterior walls of buildings, barracks, etc.; on the latter, because experiments have proved an antiseptic action of the liquid.

To Test Ivory for Genuineness.—As ivory is extensively employed and costs about twelve marks (three dollars) per kilogramme, it has been attempted to substitute a cheaper substance having the same appearance. Since about twenty years an article has been worked up in this industry, which, in contradistinction to the genuine animal ivory, has its origin in the vegetable kingdom, being derived from the nut of a palm-like shrub called Phytelephas macrocarpa, whose fruit reaches the size of an apple. This fruit has a very white, exceedingly hard kernel, which can be worked like ivory. One hundred of these fruits only costing about four marks (one dollar), their use offers great advantages. Worked on the lathe, this ivory can be passed off as the genuine article, the resemblance being so great that it is sold at the same price. It also can be colored just like genuine ivory. M. Pasquier, of Liege, now gives a practical method in Science en Famille to distinguish the two varieties of ivory. It is the following: Concentrated sulphuric acid applied to vegetable ivory will cause a pink coloring to appear in about ten to twelve minutes, which can be removed by washing with water. Applied on genuine ivory, this acid does not affect it in any manner.—Journal der Goldschmiedekunst.

ADMIRAL SAMPSON.

Acting Rear Admiral William T. Sampson is very much in the public eye at the present time, when at any moment we may expect to hear that his fleet has attacked the Spanish Cape Verde fleet.

Admiral Sampson was born in Palmyra, N. Y., February 8, 1840. His father was a farmer, and could not afford to allow his son to devote much of his time to his school books. When old enough he went to school, but it was necessary for him to do much of the hard work known to farmers' boys. The young man had an insatiable desire for information, and, despite the fact that he had less time to devote to his studies than any of the rest of the boys in the Union School, he soon distanced them in the race. Young Sampson was offered the appointment to the Naval Academy by a Congressman. He entered the Naval Academy in 1857, and graduated first in his class three years later. His first cruise was made in the frigate "Potomac," in 1861, and in 1862 he was commissioned a lieutenant. He was detailed to the ironclad "Patapsco" in 1864, and in June, 1865, while he was executive officer of this vessel, he was ordered by the admiral of the fleet to enter Charleston Harbor and to remove or destroy all submarine mines and torpedoes by which the city was protected from invasion. This was an exceedingly difficult task, for as soon as the ironclad entered the harbor, she was met with a rain of bullets from sharpshooters. Seeing a number of his men killed, Lieut. Sampson ordered them all below, while he remained as a target for the rebel rifles. The men had scarcely obeyed the order when the ironclad was blown up by a submarine mine. The vessel sank, carrying seventy of the crew with her. Lieut. Sampson was blown out one hundred feet, but was rescued with twenty-five of his men. He was attached to the Naval Academy from 1868 to 1871; in 1874 he was made a Commander. In 1879 and 1882 he commanded the "Swatara" on the Asiatic station. During the two years which followed he was stationed at the Naval Observatory, and during that time was a member of the International Prime Meridian and Time Conference. He had charge of the torpedo station in 1885 and 1886, and was also a member of the Board on Fortifications at the same time. He was appointed Superintendent at the Naval Academy in 1886 and held this position until 1890. In 1889 he was promoted to the rank of Captain, and in the next year was placed in command of the cruiser "San Francisco." In 1892 he was made Inspector of Ordnance, and in 1893 he was made Chief of the Bureau of Ordnance. He held this position until the "Iowa" was ready to be commissioned, when he was detailed to that vessel. When the fleet was sent to Havana, Capt. Sampson was placed in command and raised his flag on the cruiser "New York." At the outbreak of the war with Spain he was made Acting Rear Admiral by President McKinley.



W. T. Sampson

In the navy he is regarded as a great authority on torpedo work, and his lectures at the War College have produced a profound impression all over the world. He devised the double-deck or superimposed turrets which are now being put on the battleships "Kearsarge" and "Kentucky" in conjunction with Lieut. Joseph Strauss. While Chief of the Bureau of Ordnance he assisted in the construction of the great gun factory at the Washington navy yard. Personally, Admiral Sampson is well liked, and he might often be seen in Washington playing tennis with Secretary of State Olney. He is of slight build and his shoulders are a trifle rounded. His eyes are blue and his beard and hair are gray, and though a man of few words he is very affable. He is regarded as being very resourceful in an emergency and there is no question of the wisdom of the authorities at Washington in putting him in command of the fleet at the present time.

How Dewey Obtained His Plans of Manila.

Mr. William Doherty, an American ornithologist and entomologist of reputation, has just returned to this country from the Philippine Islands, via Hong-Kong and San Francisco. His latest distinction was in successfully passing the Spanish customs officers at Manila with the complete plans of the city, the harbor, fortifications and minute details of the armament. It was a dangerous proceeding, but Mr. Doherty carried it out successfully. The plans and drawings were concealed in a newly laundried shirt which was folded, pinned and banded in the usual style and put with other clothing in his trunk. He arrived in Hong-Kong early in April and at once delivered these most important papers to Commodore Dewey on the "Olympia."

A CURIOUSLY annoying theft is that of a negative film of the late solar eclipse, taken for the cinematograph by one of the British astronomical expeditions to India. Between Buxar, in India, and London a box was opened and only the eclipse film taken.

Patents and Warfare.

If all of the inventions directly traceable to the inspiration of war and to the feverish preparation for hostilities should be put to use to-day, the men of the navy would be kept pretty busy and the coast defense force would have to be largely increased. Nearly all of these thousands of devices for the destruction of hostile ships and men require operators possessed of more or less scientific training. Thus, when the day arrives when the "war" patents realize the expectations of their owners, fighting, both on sea and land, will become so dangerous and destructive that either whole fleets and forts and armies will be annihilated, or the very terrible aspect of such war will bring about a forced and lasting peace among the nations of the earth. This remarkable tendency in inventive genius makes it necessary to safeguard the Army and Navy Departments against the specious pleas of cranks of all kinds who are attempting to foist upon the heads of bureaus scores of crazy schemes which may be infinitely more destructive to our own side than to the enemy.

This avalanche of patented problems for war cannot be too closely scrutinized. A limit must be set, too, in the morale of the devices. For instance, every responsible government chief may well hesitate about adopting the patent of that inhuman genius who proposes to annihilate whole armies, or entire crews of warships, or the complete force in a fortification by means of a powerful gas which suffocates every living being. Such devices go along with the electrical patents to slay the enemy at wholesale at an entirely safe distance. We are not ready for that horrible weapon yet. Submarine boats may also be still classed among the extra-hazardous implements of warfare.

Civilians probably do not understand that the navy and the army distrust inventions which propose to do away with fighting. What with five thousand dollar range finders and thirty-five hundred dollar automobile torpedoes, and expensive guns and submarine boats, and dirigible electric torpedoes and searchlights, and two million dollar battleships and harbor mines and sixteen-inch guns, fighting has become more and more scientific, but there is still the element of danger that the true soldier loves, and which he cannot escape.

The wizard Edison suggests the use of large numbers of canister lights. He would fill the canisters with calcium carbide, with a small quantity of calcium phosphide mixed in. These canister lights could be placed in the water near the patrol boats or fired half a mile away from a mortar. Acetylene gas would be given off from the contents of these canisters and this would be ignited continuously by the presence of spontaneously inflammable phosphureted hydrogen. Thus, great numbers of cheap lights could be placed over an area equal to a square mile, or even more. These lights burn for a long time and reveal the approach of hostile torpedo boats, which seem to be so much feared.

Then there is an invention which resembles bottled lightning. The electricity is stored in condensers which hold as much as a celestial thunderbolt, and anything can be destroyed by it. It is unfortunate that one of the scientific experimenters with this terrible weapon was recently killed by his own lightning.

An electrical bomb has been almost completed. The flying projectile unrolls and carries along a copper wire connected with a powerful dynamo. When the bomb alights, it can be exploded by touching a button at the firing station.

Mr. Seely, in the Patent Office, has got up an electrical gun which will throw a continuous stream of projectiles containing high explosives. The range is six miles. Two Russian inventors have a device for boring the bottom of a hostile ship full of holes. This is to be done from a submarine boat or otherwise, and the holes are made by an electrical contrivance which causes the metal of the armor to melt and run down, thus leaving the hole.

Capt. Zalinski furnishes his new destructive device, which is a flying torpedo fitted with a dry battery. This is to be thrown alongside an enemy's ship and the water energizes and explodes the affair, and probably destroys the vessel.—Army and Navy Journal.

The Lobster Before a Class in Cookery.

Teachers of cooking in the public schools of New York City, where a good deal of attention is now given to this subject, have recently had the advantage of some most valuable instruction at the biological laboratory of Prof. C. L. Bristol, of the New York University. Of late special attention has been paid to those products of the animal kingdom that serve man as food, with a study of the digestive processes of the lower animals as a foundation for the study of the human alimentary system. In connection with this branch of the subject Mrs. Mary E. Williams, supervisor of cooking in the public schools, says: "Considering the prevalence of indigestion, I cannot see why anyone should be surprised because cooking teachers study digestive processes;" and in one of her recent practical lectures the subject was the lobster.

Mrs. Williams said: "There is no way to get the eatable part out of a lobster except by dissecting it. Then the animal has some unpalatable little green glands, which serve it as kidneys, and which cooks often fail to remove. They quickly decompose and generate a violent poison, and if teachers in cooking convey no part of their biological knowledge but this to their classes, it can scarcely be said to have been acquired in vain. The kidneys of fish also have an injurious effect if not taken out. The lobster is a most curious animal.

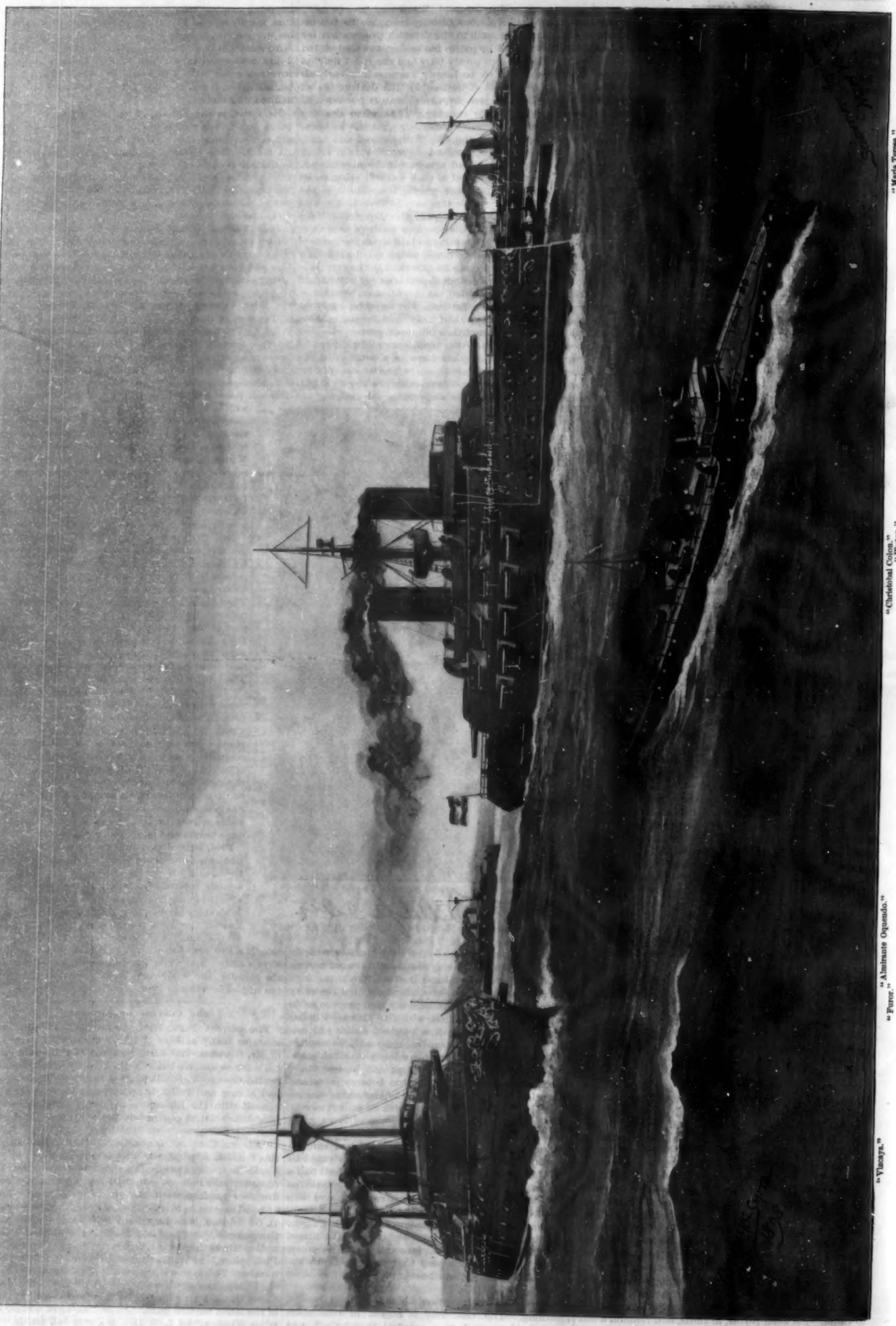
"Its stomach is located in its head and provided with teeth, and it gets a new tooth every year. The shedding of the skull is an operation which no scientist has ever been able to explain. The animal has extremely large legs in comparison with its joints, and yet it gets out of its coat of mail by drawing these huge limbs through the tiny joints. As might be expected, it is completely exhausted by the time it has accomplished the feat, and always crawls under a rock or into the sand for a couple of days to rest and let its new shell harden."

Prof. Bristol says that all animals are just as odd as lobsters when one gets acquainted with them, and his pupils appear to find them all equally interesting. Many of the teachers, instead of going home after the lecture, stay in the laboratory all day, and they have entirely conquered the usual feminine aversion to animals of the small and wriggling type. They can handle a live crawfish with as much unconcern as if it were a kitten, and when the teachers take outings in the country, the wildflowers have a rival in the various unpleasant things that grow in stagnant pools.

The Current Supplement.

The current SCIENTIFIC AMERICAN SUPPLEMENT contains many articles of timely interest. The death of Mr. Gladstone has been the event of the week, and "Gladstone and his Place in the History of his Time," by Mr. George W. Smalley, gives the views of one who had a rare and intimate opportunity for acquainting himself with the life and character of the statesman. Gladstone's latest portrait is the subject of the first-page engraving.

"Admiral Cervera" is accompanied by a portrait of this Spanish admiral, who is in command of the Cape Verde fleet. "American Competition with France in Agricultural Products," from a French point of view, discusses an important economical problem. "The Latest Discoveries of the Antiquity of Man," by Prof. D. G. Brinton, is an important article by a great anthropologist. "The Gold Fields of Australia" describes these important mines. "Malay Life in the Philippines," by W. G. Palgrave, is concluded in this number. This is one of the most interesting accounts of the Philippines which we have seen. "The Schneider-Canet Quick-Firing Breech Mechanism" describes one of the latest modern guns. "The Making of a Stained Glass Window," by L. F. Day, is a very full article.



ADMIRAL CERVERA'S "CAPE VERDE" FLEET.

THE SPANISH "CAPE VERDE" FLEET.

(Continued from first page.)

design, two of them being of 28 knots speed and one of 20 knots. The similarity in the ships is of great value in enabling the fleet as a whole to steam at any desired speed or move in any desired formation, instead of the faster ships having to wait for some slower vessels or the more powerful having to shield the weaker units when forming the line of battle. The disposition, arc of training and power of the batteries being almost identical in all the ships, a fighting position which is the best for one ship is the best for all the fleet. It is a well recognized fact in naval warfare that this homogeneity in a fleet is in itself a considerable source of strength, just as a fleet made up of ships of miscellaneous types and having various speeds must accommodate itself to the slowest and weakest units or permit them to be destroyed piecemeal by the enemy.

It is evident that the ships of the Spanish fighting line were designed with a view to fighting at a considerable distance from their home base. To this end they possess three prime requisites: Seaworthiness, habitability and a large coal supply. They stand high out of the water, they have abundance of berthing space between decks, and they are credited with a coal supply of 1,200 tons, or enough to carry them for 10,000 miles at a 10-knot speed. The fleet, therefore, has the characteristics which mark, or should mark, the ships of a nation with extensive colonial possessions, and which are conspicuously present in the British navy, whose nine battleships of the Prince George class can carry 2,250 tons of coal, or sufficient for them to steam for 19 days at a speed of about 15 knots an hour. It should be mentioned, however, that, although the theoretical radius of the "Vizcaya" type of ship is 10,000 knots, it is not likely that in actual service it is so large. The auxiliary engines on board probably consume from 8 to 10 tons of coal per day, and this is to be deducted from the amount available for the main engines.

Of the four armored cruisers in the Cape Verde fleet the "Christobal Colon" is undoubtedly the most formidable both in armor and armament. She is one of six similar ships built or building at Sestri Ponente, in Italy. Two of these, the "Guiseppe Garibaldi" and "Varese," are being built for the Italian navy; two, the "Garibaldi" and the "San Martino," form part of the Argentine navy; the other two are the "Christobal Colon" and the "Pedro d'Aragon," now under construction for Spain at the Italian yard. The most striking feature in these ships is the unusual amount of side armor which they carry, in which respect they are only surpassed by the French "Dupuy-de-Lome," which is entirely covered from stem to stern with 4 inches of steel. The "Dupuy-de-Lome" was designed after the French experts had proved the terrific destructiveness of shells containing high explosives, and realized the necessity of preventing their bursting within a warship. The "Christobal Colon" is not so completely covered as the "Dupuy-de-Lome," but her armor is thicker and of Harvey steel. In the first place she has a complete waterline belt of 6-inch Harvey steel. Above this and extending for about two-thirds of her length amidships is another belt of 6-inch steel which reaches to the upper deck. At each end of this belt are transverse bulkheads of the same thickness which extend clear across the ship and join the side walls of armor, thus constituting a great oblong fort or citadel. Within the shelter of this citadel is a powerful battery of ten 6-inch rapid-fire guns, five on each broadside. Each of these guns can be fired five or six times a minute, and the 100-pound shells have a muzzle energy of 4,645 foot tons and are capable of penetrating 21 inches of iron at the muzzle. Placed within the shelter of the citadel, one forward, one aft, are two barbettes of 6-inch steel which protect the turning gear of two 10-inch guns, which are the most powerful weapons carried by the ship. They throw a 500-pound shell with a muzzle energy of 14,430 foot-tons, which can penetrate over 20 inches of iron at 1,000 yards. Above the 6-inch battery is another rapid-fire battery of six 4·7-inch guns, each capable of firing 7 or 8 shells per minute, which are good for a muzzle penetration of 15 inches of iron. These guns are protected by shields of Harvey steel. It will be seen that the armament is not only extremely powerful, but unusually well protected. The secondary rapid-fire battery consists of ten 6-pounders and ten 1-pounders, with two machine guns in the tops. There are also four Whitehead torpedo tubes, protected by 6 inches of armor. The speed is 20 knots and the coal carrying capacity 1,000 tons. It should be mentioned that, in addition to the belt and citadel armor, the "Colon" is further protected as to her vitals by a 1½-inch deck, a cofferdam of water-excluding cellulose and the arrangement of her coal. Of the four ships of the Cape Verde squadron, she easily stands first in all round fighting efficiency.

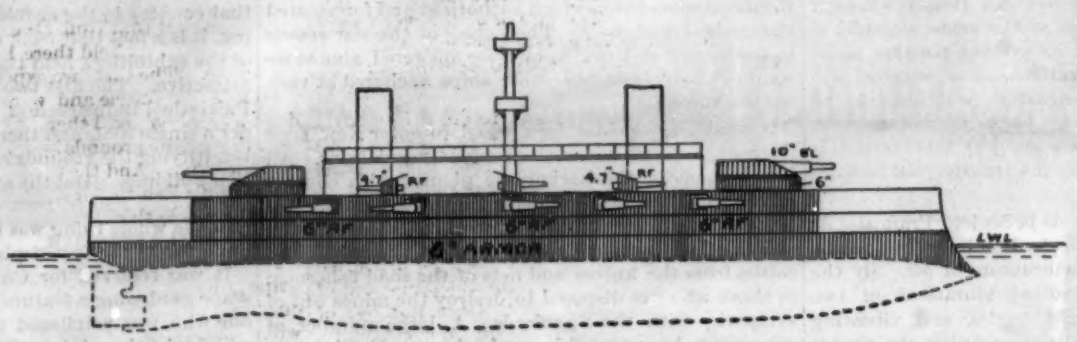
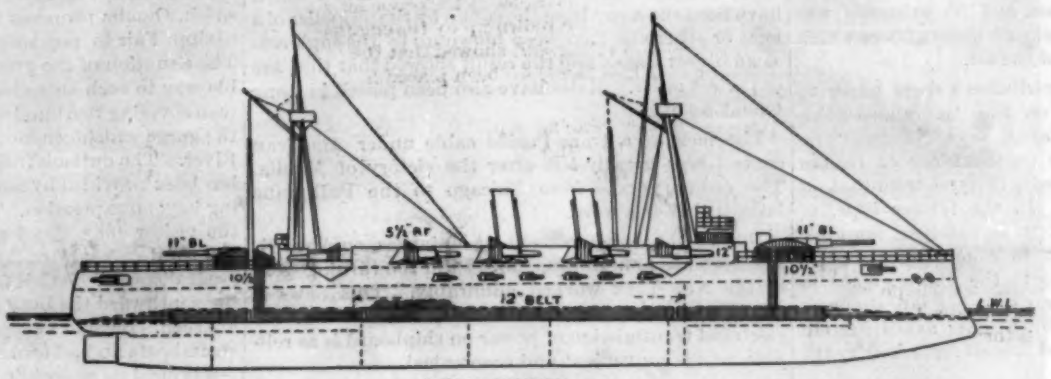
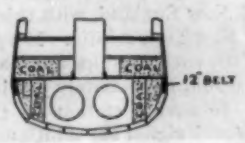


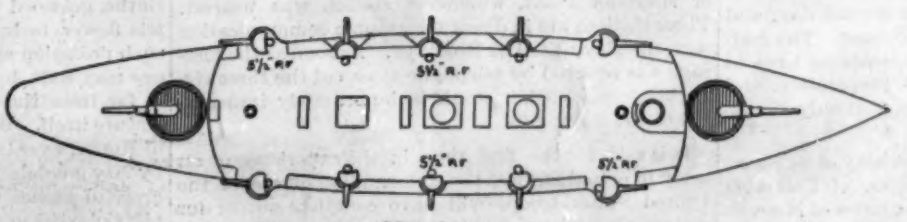
DIAGRAM OF GUNS AND ARMOR OF ARMORED CRUISER "CHRISTOBAL COLON."



SIDE ELEVATION



CROSS SECTION



DECK PLAN

DIAGRAM OF GUNS AND ARMOR OF ARMORED CRUISERS "VIZCAYA," "MARIA TERESA" AND "OQUENDO."

The other three ships, "Vizcaya," "Maria Teresa" and "Almirante Oquendo," were built at Bilbao, Spain, and launched in 1890 and 1891. Their principal dimensions, etc., are as follows: Length, 340 feet; beam, 65 feet; draught, 21½ feet; displacement, 7,000 tons; speed, about 20 knots for the "Teresa" and "Oquendo" and 21 knots for the "Vizcaya." The water line for over two-thirds of the length is protected by a belt of steel 12 inches thick and 5½ feet deep, part of it being below and part above the water line. At each end of the belts a transverse bulkhead of steel of the same depth extends across the ship to prevent a raking shot from entering the engine and boiler rooms. At the top of the belt and bulkheads, or about two feet above the water line, is a steel deck 3 inches in thickness, which is level between the bulkheads, but curves down to meet the stern and stem (see diagram) below the water line. So far, so good, as regards armor protection. The weak point in this respect is the fact that the sides of the ship above the belt are entirely unprovided with armor. There is thus a space the full depth of two decks, or say about 15 feet, which is penetrable by the smallest shells. It is true there are several feet of coal stowed in the wake of the engines and boilers on the berth deck above the belt, and while this might stop and burst the shells, it would not burst them on the outside of the ship, as would the 6-inch side armor of the "Christobal Colon."

The armament is powerful, though not equal to that of the "Colon." Its lack of armor protection however detracts greatly from its efficiency. There are two armor-piercing 11-inch guns, one forward and one aft, which fire over 10½-inch steel barbettes carried on the main deck. The barbettes communicate with the magazines below the protective deck by means of thick armored tubes, as shown in the diagram, which will serve to protect the ammunition on its way up to the breech of the guns. Apart from the tubes, however, there is nothing but the thin ½-inch plating of the ship's sides to prevent shells from being burst beneath the barbettes. It would not take many such shells, even from rapid-fire guns, to cut away the plate framing and girders that support the great weight of the barbette gun and turning gear and tumble the whole structure into the hold of the ship. The same thing is true of the amidships battery of ten 5½-inch rapid-fire guns on the same deck. High explosive shells bursting beneath them would break up the deck and inevitably put them out of action. Four of the 5½-inch guns are carried on sponsons, which extend out from the sides of the ship and enable the guns to be trained fore and aft. On the gun deck below are eight 6-pounder and eight 1-pounder rapid-fire guns and in the tops on the fighting masts are two machine guns.

The 11-inch gun shown in our front page engraving is a very formidable piece, capable of penetrating the belts and gun positions of our battleships at the ordinary fighting range. It is a 35-caliber weapon of the Hontoria type and weighs about 36 tons. With a charge of 352 pounds of powder it fires an armor-piercing shell of 694 pounds with a velocity of 2,034 feet a second. The shell has a muzzle energy of 24,000 foot-tons and is capable of perforating 28½ inches of iron at the muzzle. This weapon, therefore, approaches the 12-inch rifle Mark I of our navy, which has a foot-ton energy of 25,985 and a penetration of 30·8 inches.

The curious domelike structure above the gun is a light shield a few inches in thickness which is bolted to the carriage and rotates with the gun, the barbette being stationary. The shield is too thin to stop the heavier rapid-fire shells, which it would only serve to intercept and cause to burst inside. The Chinese removed the light shields of a similar kind from their guns on the "Chen Yuen" before the battle of the Yalu, considering the gun crews would be in less danger without them; though the Japanese, who now are the owners of this ship, have replaced them, probably making them thicker and of better steel.

The four cruisers of the Cape Verde fleet are all liberally supplied with torpedo tubes, the "Colon" having four and the other three ships six, two of which are submerged. The above-water tubes, owing to the terrible risk of having the torpedoes hit and exploded on the ship itself, are not likely to be used; but the underwater tubes are very dangerous weapons, and if the swift Spanish ships should steam in to close range, they might even the fortunes of a losing fight by sinking one or more of the enemy.

Accompanying the cruisers and acting as very useful scouts are three torpedo boat destroyers of the latest design and of exceptional power and speed. Two of them, the "Furor" and "Terror," which were built on the Clyde in 1896, are sister boats, 220 feet long, 23 feet beam, of 5½ feet draught and 380 tons displacement. They have engines of 6,000 horse power and are capable of 28 knots speed. They carry 100 tons of coal and, contrary to the popular opinion, can cruise for several thousand miles at 10 knots without replenishing their bunkers. They have two torpedo tubes and carry a crew of 67 men. The "Pluton," built last year on the Clyde

is 5 feet longer, 3½ feet broader and of about the same draught. Its displacement is 400 tons, and its engines of 7,000 horse power drive it at a speed of 30 knots an hour. The three boats are, therefore, two-thirds the length of the big cruisers and are good seaworthy vessels capable of going anywhere with the fleet. They are heavily armed, carrying two 12-pounders, two 6-pounders and two 1-pounders, and would be capable of sinking any torpedo boats they might overtake.

Such is the Cape Verde fleet, whose speed and wide radius of action have already earned for it the title "elusive." Incapable of meeting our battleships in action with any hope of success, its admiral appears to be content with threatening our communications and giving assistance to the beleaguered island by acting as a diversion to the fleets of Admiral Sampson and Commodore Schley. The question of the capture or destruction of the Cape Verde fleet is first and last a question of coal supply, for it will be the scarcity of this that will ultimately drive the Spanish admiral to an active engagement or send him back to Cadiz.

Science Notes.

M. Vallot's observatory on the top of Mont Blanc is to be moved from the Rochers des Bosses, where it now stands, to a rocky point at the same altitude, as the piling up of the snow in its present position interferes with scientific observations. The removal will be difficult, as the whole structure will have to be taken piece by piece on the backs of workmen to the new site at a height where any physical exertion is exhausting. It is hoped that the transfer will be completed in one season.

According to the Bulletin de la Société Française de Physique, M. Crémieu has devised an ingenious means of producing elliptic sound vibrations in air. By the interference of the longitudinal vibrations of two organ pipes, placed at right angles, and vibrating under the influence of two diapasons with the proper difference of phase, an elliptic motion was set up at the intersection of the tubes, and its existence was made evident by means of delicate quartz fibers which followed all the movements of the air.

Prof. Theobald Fischer contributes a short paper to Petermann's Mittheilungen on the "moraine-amphitheater" of the Lake of Garda, says Nature. The form of the moraine deposits on the inner or Italian side of the Alps differs markedly in type from that on the outer or German side. In the former type, of which the Lake of Garda affords an excellent example, the deposits are laid down in concentric ramparts which turn their convex side to the plains; while in the latter we find the familiar expanded fan shape at the mouths of the valleys. Dr. Fischer avails himself of the very excellent maps and models furnished by the Italian service.

A rather remarkable accident with chloroform is reported from the Catholic Hospital at Herne, Westphalia. It appears that a man had to be operated upon at once for a gunshot wound, and the operation being difficult, the time extended to about four hours. The illuminant in the room was gas, and it is supposed that it decomposed the chloroform with evolution of chlorinated vapors, with the result of incapacitating the two surgeons and so seriously injuring the sisters in attendance that one died on the second day, and the lives of the others were in great danger. The matter is of special interest, because operations have to be performed occasionally without preparation, and it would seem, from this experience, that only the incandescent electric lamp can be safe.

At a meeting of the New York Academy of Sciences, on January 24, Mr. E. L. Thorndike, of Columbia University, gave an account of a long series of interesting experiments on comparative psychology. These experiments were made upon cats, chickens, dogs, monkeys and other animals, and were supplemented by the experience of professional animal trainers. According to a report in Science, cats were placed in boxes with doors so arranged that they could be opened from the inside in various ways, in one set of experiments by pressing a latch, in another by pulling a cord, by pulling a hook attached to a cord, or by turning a button. Again the arrangement was more complicated, and two or three separate movements had to be combined in order to release the door and let the animal out to reach the fish placed outside the cage. Curves were given showing the rate at which the kittens learned the various tricks, the time taken to get out becoming gradually shorter. The trick was always learned by accident; one lucky hit would prepare the way for another. There was no trace of rational inference. Seeing another animal do the trick a hundred times was no help. Nor was it possible to teach the trick by taking the kitten's paw and putting it on the latch, and so opening the door, no matter how often it was repeated. A habit once formed artificially will overpower natural instincts. A chicken that had been compelled to jump from a box to the floor in a roundabout way by a cardboard placed in its way, felt unable to jump down to its food directly when the card was taken away.

Electrical News and Notes.

Prince Victor Emmanuel of Naples is said to be an expert electrician. He experiments on all its applications to light, sound, motive power and photography, and was one of the first persons in Italy to investigate the Roentgen rays.

It is reported that a huge central station will be constructed in Saxony to supply electricity throughout the kingdom; 168 towns will be connected with the station.—Electrotechnische Rundschau.

Twelve thousand mail cars of the German railroads are now lighted by electricity, storage batteries being employed. The light has given full satisfaction and is also said to be cheaper than the gas light used hitherto.—Uhland's Wochenschrift.

The Western Electrician has paid great attention to the electrical aspects of the war and has published several columns each week devoted to this subject. A report from Hong-Kong brought by the steamer "Gaelic" states that the night before this vessel left Hong-Kong, Commodore Dewey gave an exhibition of electric light signaling. The Commodore is particularly interested in this branch of naval tactics, as he was at the head of the naval commission which authorized and formulated the method and code. The signals of the war vessels in the harbor of Hong-Kong were answered almost instantaneously from the other ships anchored at various distances.

It would be suicidal for a vessel to enter New York Harbor at night under the present regulations. All the channels of the harbor are planted with contact mines, which, while harmless in the day time, would explode at night by contact. Patrol boats enforce the orders of the authorities and protect the mines and cables from the knives and nets of the shad fishermen or those who are disposed to destroy the mines out of sympathy with the Spaniards. A large number of mines have been placed in our harbors on the Atlantic and the Gulf coast. One or two of the mines which have been cut away from the cables by the propeller of a boat or otherwise have been blown up by the engineers as an object lesson, and the result showed that they are in perfect order. Mines have also been placed in Long Island Sound.

The lack of a trans-Pacific cable under American control was greatly felt after the victory of Manila. The ordinary rate from Chicago to the Philippine Islands is $3.41 a word.

During the bombardment at Matanzas, on April 27, the electrical ammunition hoists and the turning gear of the New York worked admirably. This news is specially gratifying to those who contended that the electrical transmission of power on shipboard is as reliable as it is convenient and economical.

An elaborate signal service system along the southern coast of New England, with thirty-four stations, is manned by New York militia. If a patrol boat should sight one of the enemy's ships approaching Long Island Sound, she would immediately put in under full steam for a coast life saving station on the southern Long Island shore and signal the militiamen stationed there of the approach of the invading ship. The news would at once be sent on by telephone to Fire Island, Quogue or Montauk Point, whichever station was nearest. These stations are in direct telegraphic communication with the Navy Yard at Brooklyn. As soon as the message was received by telephone at one of the three signal stations named, it would be immediately transmitted to the Navy Yard.

It is said, for the first time in the experience of an army in actual service, the commanding officers of the United States troops will have complete outfits for maintaining telegraphic communications with the various brigades and regiments that go to make the divisions and corps of the army. General Greely also has equipped and has ready for service his field telegraph outfit.

The War Department has decided to erect sets of the "telephotos" at the fortifications at Boston, New York, Fort Monroe, Key West and San Francisco, so that news, instruction and general communications may be transmitted by night as well as by day between the army fortifications which will be in telegraphic communication with Washington and the fleets or vessels of the navy which may be under the guns of the forts or in adjacent waters. It is the intention of the government to equip other stations along the coast with these signals. The inventor has devised a small automatic auxiliary engine connected to a dynamo of sufficient size to supply the lights of the "telephotos." This could be installed at a small cost and could be run without requiring the services of a skilled engineer or attendant.

The great 60-inch search light which was used at the World's Fair now guards the approaches to the harbor at Norfolk, Va., the latter being protected by means of submarine mines. A modern battery of rapid-fire guns for use against torpedo boats and light-draught gun-boats have greatly increased the efficiency of the fort.

THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION AT OMAHA.

The greatest exposition of America's resources and the products of a nation's thrift ever witnessed, with the single exception of the World's Fair at Chicago in 1893, will take place on the banks of the Missouri in the summer and fall of 1898, at Omaha, Neb. It was at first intended to make the exhibition a regional one, devoted to the products, arts and industries of the States west of the Mississippi River, but this plan expanded as the work progressed, and all the States were invited to take part in it. Then there was some attempt to make it international in character, the foreign flavor being dear to American hearts at American fairs, as is just and natural, and this attempt has been quite successful, as several countries will participate. The work of preparation is well under way, and there is satisfactory assurance that every building will be completed and every exhibit in place when the gates are opened to the public on June 1. The exhibition will continue open until November.

Anyone who visited either of the Paris expositions will readily concede that, although no nation surpasses the French in artistic capacity and perhaps none equals that country in the development of landscape gardening, it is a fact that from an exterior point of view all of the exhibitions held there have been singularly unattractive. The first two expositions were held in the Palais de l'Industrie and were completely housed under a single roof, and there was no special attempt at beautifying the grounds immediately about the Exposition building. And the same was true, in a degree, of the World's Fair in 1889. The space was so valuable that the whole thing was crowded, and there was little opportunity for any display of landscape gardening.

It was reserved for Chicago, in 1893, to make landscape gardening a feature of the World's Fair; and no one who was privileged to see that dream of beauty will doubt the wisdom of the effort.

Profiting by the experience of the Columbian Exposition, Omaha proposes in the forthcoming Trans-Mississippi Fair to pay special attention to scenic effect. The situation of the grounds lends itself in a remarkable way to such an endeavor. There is a splendid plateau covering two hundred acres, breaking off sheer into the gorge which constitutes the valley of the Missouri River. The outlook from the top of this bluff, which has been provided by nature, is magnificent and inspiring beyond expression. Throughout a stretch of a mile the visitor may stand and with his eyes sweep that beautiful valley, with the bluffs of Iowa beyond, for a great distance. At his feet the river bank and stretching southward the busy outskirts of the city of Omaha are seen. Beyond sweeps the majestic river, laden with steamboats and all forms of passenger and freight craft —a typical scene—while in the distance are the marshland bottoms backed by the imposing mesas of the adjacent State.

But this is all natural and God-given. It is to that which art is developing—the exposition grounds proper —that the visitor will turn with chief interest. The landscape gardening on what is known as the Bluff Tract promises to be most imposing. A vast quantity of flowers, shrubs and trees will be set out so as to form a beautifully shaded garden spot. There will be labyrinths, graveled walks, the more conventional geometric flower beds, hedgerows and lovers' nooks, all in such profusion and with such a wealth of verdure that one may walk by the hour in the serene belief that he is far from the madding crowd in the fastnesses of Nature itself. But in sharp contrast will be the Court of Honor, over the way. Here the long lagoon, dotted by lazy gondolas, weaving in and out and under the graceful arches of the bridges; the picturesque fountains playing in the bright sunlight, the walled sides of the water flanked by the greenest of grass plats, with here and there a pedestaled Apollo or laughing faun, a Bacchus or the struggling Laocoon or the classic figure of the Venus de'Medici, backed by the imposing line of stately buildings and graceful arches and colonnades—all these will make up a picture of amazing beauty and impressiveness. It will not be a "White City." The artists have hit upon a color scheme which will relieve the scene from the hard glare of monotonous concrete, so trying to the eyes at Chicago. The buildings are to be done in neutral tints of Pompeian red and brown and ocher. This is daring and at first thought would seem incongruous. But careful tests have been made, and all now agree that it will be a great improvement. It will really be suggestive of Sienna marble, and will be most harmonious and effective.

The marvelous progress that has been made in the grounds has effectually dispelled any fears that the buildings would not be ready in time or that the opening might be delayed. The experience gained from former expositions has enabled contractors and workmen to erect and complete exposition buildings much more rapidly than was possible even five years ago, and the task of installing exhibits will be a comparatively easy matter, as every inch of space is shown on plans drawn for the purpose of facilitating the work. The governing board has acted wisely in employing a firm of Boston architects to make the general plan of the

grounds and to control the whole building scheme; the principal buildings have been divided among the best architects of Western cities.

The beautiful building of electricity, simple, but effective in design, stands nearly finished. Its ornamentation, symbolic of its exhibits, shows clear designs in cogwheels and electrical machinery. The most complete and elaborate display of everything pertaining to the infant yet ever-developing science will be shown. Tesla, Edison and Prof. Thompson will have individual exhibits.

In the section devoted to machinery will be found a splendid and complete collection of agricultural mechanism, the finest ever exhibited at any exposition.

The Agricultural Building will command much attention and the Temple of Ceres is well fitted to exhibit the agricultural products of this wonderful Western country. Facing it and across the lake, is the Fine Arts Building. It is constructed in form of two Greek crosses, which are connected by a court. A splendid art collection is being made and new exhibits are promised every day. The building itself will be one of the most beautiful on the grounds. It will be finished in ivory, but a frieze five feet high, which surrounds the building, will be artistically colored, and will add a contrasting bit of beauty to the whole conceit.

The Government Building, which, with its huge dome and immense wings which flank it on either side, reminds one so strongly of the national Capitol at Washington, will stand facing the lake and overlooking the main court. Curving colonnades which stretch away on either side connect it with the Agriculture and Fine Arts Buildings. Surmounting the dome will be a reproduction of the famous "Liberty Enlightening the World," and from the ground to the torch in her hand the distance will be 178 feet. The statuary which will adorn these different buildings is well nigh completed. That which will ornament the Government Building was made in Washington, D. C., while that of the Electricity, Manufactures, Fine Arts and other buildings has been made in Chicago, St. Louis, Nashville and other cities.

Across Sherman Avenue is a viaduct which connects the Main with the Bluff tracts. The latter will contain the State Buildings, the Horticultural Building and the Midway.

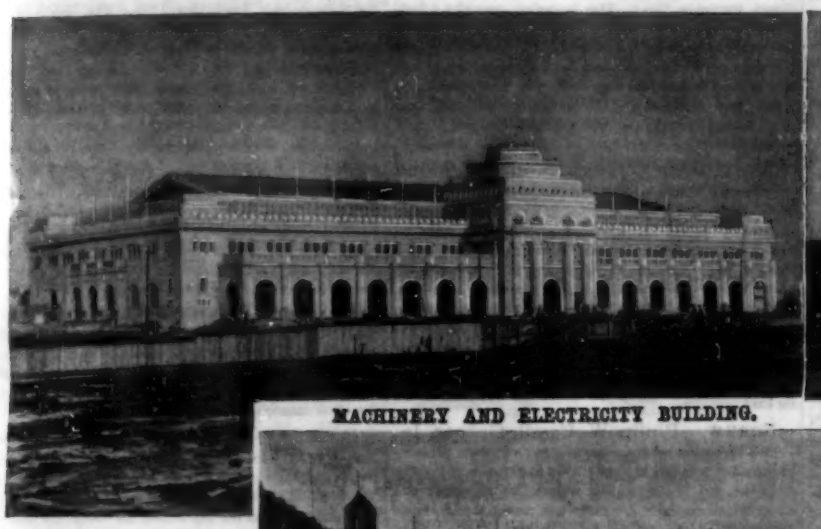
The Horticultural Building is designed in the Corinthian and Ionic styles, and will furnish 27,000 square feet of space for exhibits.

The main feature of this building is a central dome, with an open gallery from which visitors may view the surrounding country from a height of 110 feet. The main entrance will be through a portico supported by free Corinthian columns.

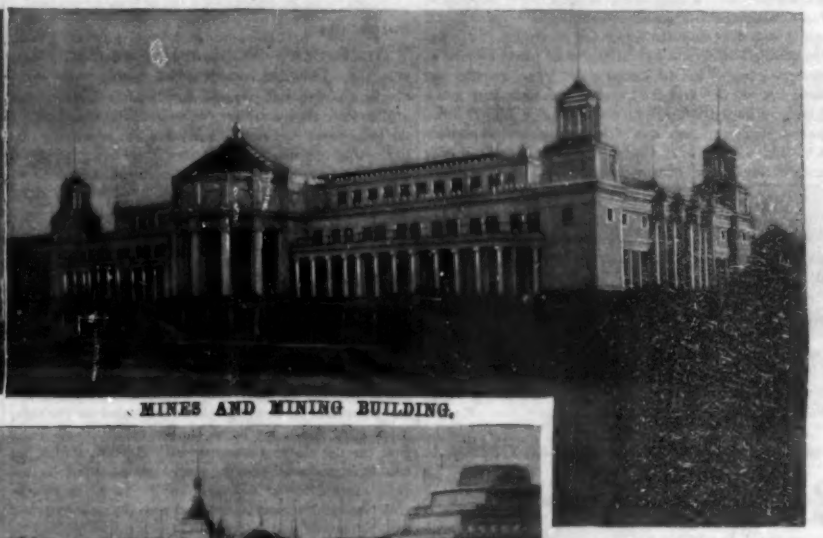
The State Buildings are progressing rapidly. Illinois will have an exceedingly pretty and pretentious home, designed in a combination of Greek and Byzantine architecture, with a dome 115 feet high. Nebraska's commodious building is 90 by 145 feet. Iowa, Wyoming, Colorado, South Dakota, Wisconsin, Montana, and even far-off New Jersey are already at work in the preparation of plans for buildings. One of the most novel will be Georgia's Pine Palace, built of native lumber and highly polished. An immense wigwam will represent Pottawattamie County in Iowa, while Missouri will boast of three beautiful buildings. The other State buildings are rapidly materializing, and it will be safe to say that when the exposition opens its gates on June 1, no less than thirty-four of our States will be fittingly represented.

A curious innovation will be a Bureau of Courtesy. Not only is the idea novel, but it is surprising to learn that nearly all the people in Omaha will be enrolled in the committee. Every member will wear a badge, and visitors will be at liberty to address anyone wearing one of these badges, and ask for any information they may like. The member, on the other hand, will be pledged to treat the visitor courteously and answer his questions or put him in the way of getting them answered.

The transportation facilities are excellent, and extensive preparations are being made for the entertainment of the guests. With a number of good hotels, together with the many new lodging houses being erected, there will be no scarcity of excellent accommodations.



MACHINERY AND ELECTRICITY BUILDING.



MINES AND MINING BUILDING.

VIEW WEST FROM TOBOGGAN.

VIEW NORTHWEST FROM WEST DOME OF FINE ARTS BUILDING.

VIEW NORTHEAST FROM WEST DOME OF FINE ARTS BUILDING.

THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION AT OMAHA.

A Parisian Scientific Toy Picture Book.

The pictures represent the most familiar domestic animals, and each animal speaks its own language. To cause it to break silence, it suffices to pull a little string at the edge of the book. Here are a rooster, a cow, a lamb, little birds in their nest, a donkey, a cuckoo, a goat. On the last page are children who are welcoming their parents. If we pull at each page the string spoken of above, we shall hear the characteristic cry of each creature. The rooster crows, and his cry is very well imitated. The donkey hee-haws, the lamb bleats, the little birds twitter, the cow moos, the cuckoo sings, and the little children call out "papa" and "mamma." These various results are obtained very simply with the aid of small bellows placed in a box hidden in the book. When the string is pulled the air enters the corresponding bellows, and is then expelled by a spring that tends to return the bellows to its original position. The air makes its exit through a special tube appropriate for each cry, and at the same time the bellows meet with certain obstacles placed on a wire. These arrangements have been carefully studied with a view to producing the proper sounds.—La Nature.

THE legend of Romulus and Remus being suckled by a she-wolf passes for a fable, but the researches of naturalists lend it color. In India native children have been nursed by wolves and lived with them. Negroes aver that anthropoid apes have suckled babies. Romanes has cited as a fact the suckling of three young rats by a cat whose kittens had been taken from her.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

GRASS CLIPPING DEVICE.—John McCallam, Chippewa Falls, Wis. This grass cutting device comprises cutting and operating mechanisms, a guiding handle formed in two parts screw-threaded on each other, each part having one of the mechanisms attached thereto, and an arm mounted upon one part having a locking pin thereon. The adjacent end of the other part is provided with a series of holes arranged on a spiral corresponding to the thread of the connection and adapted to receive the locking pin. The device can be worked by one or both hands of the operator and can be easily moved in any direction, so as to clip grass around trees or shrubbery.

COMBINED COTTON SEED PLANTER AND FERTILIZER DISTRIBUTER.—Walter G. Gray, Marrowbone, Tenn. The inventor has in this patent devised a machine which is designed to make a ridge, trench and top it, plant the cotton seed and supply the fertiliser, and which will then close the trench in the ridge, covering the seed, all of which operations take place almost at the same time or in quick succession. The machine is, furthermore, provided with plows enabling it to make a large or a small ridge, with either two or four furrows to the ridge. A novel seed-distributing device permits but a few seeds at a time being taken from the hopper and delivered to the drill or chute.

CORN HEADER.—William A. Wilson, Centropolis, Kan. This machine comprises a frame, a platform mounted to swing thereon, a lever fulcrumed on the axis of the platform and having its upper portion extended forwardly beyond the axis, a standard fixed to the platform and having a sliding connection with the upper end of the lever, a link pivoted to the lower end of the lever and extending forwardly, a hand-lever mounted on the frame and connected with the link, and a bell-crank lever also mounted on the frame and connected with the link, the bell-crank being within reach of the driver's foot.

Bicycle Improvements.

BICYCLE CANOPY.—Jacob J. Metzger, Cleveland, O. In this canopy a base section capable of being attached to the stem of a bicycle, supports a tubular standard in which a rod is adjustably held. A block is located at the upper end of the rod and is adjustably held thereto by a thumb screw. Two pivotally-connected members are mounted on the block and form a fork, the arms of which extend upward and outward in opposite directions. To the upper ends of the members the canopy is attached, which is, consequently, adjustably held in place. The canopy can also be used as a sail both in running with and reaching on the wind.

HANDLE BAR.—Thomas Vantuyl, Nichols, Ia. This handle-bar comprises a handle-bar stem formed with a head having internal notches, a fitting mounted to turn in the head and formed at its ends with bearings, handle arms engaging the bearings with their inner longitudinal ends, and a key held in the fitting and engaging notches in the handle arm ends and notches in the head. The arms are designed to permit independent adjustment either longitudinally or transversely.

Engineering

GAS OR OIL ENGINE.—Frank S. Mead, Montreal, Canada. This engine consists of a power cylinder, a channel for the supply of compressed air, a channel for the supply of liquid fuel, a passage leading from both channels to the cylinder, and a piston actuated by the engine and so arranged as to control the admission of air and fuel to the cylinder. A spraying device is located adjacent to the working chamber, and to the spraying device the valved delivery port of an air compression pump is connected. The delivery tube is directly controlled by the movement of the pump-piston for injecting a spray of liquid fuel into the working chamber after the exhaust is closed.

DIFFERENTIAL PISTON VALVE.—Nicholas Power, New York City. The valve-body of this valve is provided with an inlet and outlet and a valve seat. A cylinder is secured to the valve body above the valve seat and has its lower open end in communication with the inlet of the body. A piston located in the cylinder is provided with a loosely sliding stem by which it is operated and with a stem projecting from its lower end. A valve is loosely mounted on the stem projecting from the lower end of the piston and is adapted to rest upon the valve seat. The area of the top of the valve being greater than that of the piston, the valve is held to its seat. When raised from its seat, the pressure of the fluid on the lower end of the piston will cause it to slide upward to open the valve entirely and hold it open.

Electrical Appliances.

ELECTRICAL STEERING APPARATUS.—Harry O. F. Bindemann, Madrid, Spain. Connected with a rudder, oppositely rotating motors and clutches for operatively connecting the rudder with either of the motors, are an axle or pivot controlled by the operator, a switch arm capable of a limited rotary movement relatively to the pivot and having an inclined surface, a pin projecting from the pivot and engaging the inclined surface, a spring for keeping the pin against the inclined surface, contact devices arranged to be engaged by the switch-arm and electrically connected to the clutches, and means for holding the rudder stationary after it has reached the desired position.

ALARM.—Ira B. Frazee, Blairstown, Ia. This invention relates to an improvement adapted particularly for detecting the fraudulent entrance of persons into buildings. The device consists of a casing containing the alarm apparatus and its battery, which apparatus is in connection with the terminals of an electric circuit. By the delicate adjustment of a weight, an arm upon which the armature of an electro-magnet is carried is so arranged that it shall drop upon a contact post, causing the alarm bell to ring, should the electric circuit which runs through the places to be protected, be broken. By an ingenious device, the bell is made to ring incessantly until, by manual force, a crank shaft is turned, which, acting upon various devices, causes the alarm bell circuit to be broken, thus stopping the alarm.

Mechanical Devices.

CENTERING MACHINE.—Jacob H. Brewer, New Straitsville, O. This centering machine comprises a series of revoluble spindles adapted to carry a squaring tool, a drill and a reamer arranged in the same plane, a carriage mounted to slide toward and from the tools, a cross-slide movable on the carriages at right angles to the movement thereof, a holding device on the cross-slide, for holding the work in the same plane as the tools, means for moving the carriage forward and backward to carry the work to and from the tools, and means for adjusting the cross-slide, to carry the work successively in alignment with the tools, and for locking the slide to the carriage after it has been adjusted. The machine is especially designed for conveniently and accurately centering the stock to be turned in a lathe or like machine.

DIE STOCK.—William H. Sweitzer, Danville, Ill. Connected to a die-stock having radial handle bars and radial recesses for dies in opposite faces of the stock are a number of thread-cutting dies engaging the recesses of the stock, a central die occupying the recesses on one side and the other dies being disposed about the center and in the recesses on the other side of the stock, each die comprising a fixed section and a movable section, and a set screw bolt for adjusting each movable die section, the bolts each having a threaded engagement with the die stock.

RAILWAY SWITCH.—William Harris, Belleridge, Pa., and Wilbur J. Harris, Mount Pleasant, O. This invention makes use of a deflecting rail and fixed switch points in connection with mechanism mounted upon the car and under manual control; the switch points may be made to engage the deflecting rail to shift the car sideways. The mechanism upon the car comprises an eccentric sleeve journaled on the axle, a deflecting wheel journaled on the eccentric sleeve, a gear on the sleeve concentric with the axle, a rock bar held in engagement with the gear, a pinion fixed to the axle, a frame having top and bottom racks engagable with the pinion and connected with the rack bar, and suitable levers and springs by which the frame may be depressed or raised to engage either rack with the pinion, and thus to cause its horizontal movement in either direction, and by reason of the connection with the rack bar to turn the eccentric sleeve in either direction. The frame is also constructed with locking recesses receiving the pinion to limit the horizontal movement of the frame and to hold it in either extreme position.

BENDING MACHINE.—Charles Seymour, Defiance, O. In this bending apparatus a form is supported on a frame and two bending arms are mounted below the form. A master strap extends from one arm to the other, means being also provided for swinging the arms. A rope is run beneath the arms and rolls over pulleys carried by the frame. Springs serve to draw the rope taut beneath the arms, the rope forming a yielding support for the inner ends of the arms, and serving to thrust the arm toward the form, thus causing the timber to be bent which is contained between the arms.

AUTOMATIC VEHICLE BRAKE.—Joseph Samuel Elliott, Eddy, Tex. Connected with brake-beam rods and levers arranged in the rear of the brake-beam and in the same plane therewith, are a yoke having a central hook to which a spring is attached, a threaded pull-rod passing through a threaded bore in the yoke, and a hand mechanism comprising a lever arranged parallel to the brake levers, the rod and the hand lever. The brake apparatus is connected with a link suspended from the front axle. Through a device consisting of an elongated link having an upward curve at its middle the pull rod passes and has a cross-pin arranged in the rear of the curved portion of the device. To the front end of this device the lift lever and rod are attached. The brakes are applied by the team when holding back, such result being obtained through the flexible connection between the neck yoke and levers operating the brake beam.

Miscellaneous Contrivances.

COFFEE ROASTER.—William R. Ramsey, Keno, Ore. This coffee roaster comprises a rectangular receptacle, one end of which is provided with a bearing and the opposite end of which is provided with a downwardly, horizontally and thence upwardly extending slot, the upwardly extending portion of which forms a bearing aligned with the bearing in the first named end of the receptacle. A cylinder is located within the receptacle, one head of the cylinder having an opening therein, and a hingedly mounted plate is capable of swinging over the opening to close it. A shaft is passed through the cylinder, is mounted in the previously mentioned bearings, and is connected and disconnected with the receptacle by means of a slot in one head thereof. A handle is attached to the shaft, whereby the shaft may be revolved.

DRY VACUUM COOKER.—Herrmann A. Wolf, New Haven, Conn. The object of this invention is to provide an improved cooking apparatus in which the materials will be cooked dry, i. e., in their own juices, without water. The apparatus comprises a casing provided with a surrounding water space, having a packing at its bottom and a cover casing open at one end and closed at the other, the closed end being provided with a valve and with packing, the packing at the closed end of the casing being arranged for engagement with the upper portion of the inner wall of the water space, the sides of the cover casing being arranged to extend within the water space to form a double water jacket and its open end to engage with the packing in the space. The cover casing is provided with a locking device, and vessels adapted to receive the articles to be cooked are located within the body casing beneath the closed portion of the cover casing. Locking devices are provided for the covers of the vessels.

JAR.—Julian P. Lyon, Detroit, Mich. This invention is an improvement in that class of jars in which the cap is securely held by atmospheric pressure and without the use of a fastening device, the invention being of such construction that the cap may be readily displaced without injuring the gasket and without chipping the material of the jar. The gases, moreover, may be automatically and effectively exhausted during the process of preserving the contents of the jar.

COMBINED CHAIR AND BEDSTEAD.—Joseph Dixon, London, England. This combined folding chair and bedstead comprises a legged seat frame, a leg rest slidable thereon, and provided with separate legs, a back frame pivoted on the seat frame and adapted to form a bed extension therefor in an opposite direction to the slidable leg rest, a brace pivoted on the back frame, extension legs pivoted on the brace and adapted to engage the back frame and means for locking the brace in place on the back frame. The chair can be conveniently folded for storage and is designed for use as a reclining chair, sitting chair or bedstead.

END GATE FASTENING.—John S. Court, Memphis, Tenn. This invention provides a fastening for end gates, which fastening has an eyebolt or eyebolts run through the sides of the wagon body just rearward of the end gate and held by a vertically extending rod which passes through eyes in the bolts and which also engages sockets formed one on each wear plate for the eyebolts, by which sockets the rod is held steadily.

ASH SIFTER.—James H. and Edmund W. Counties, Camden, N. J. A casing having an opening in its bottom and an opening [illegible] and a screen diagonally placed in the casing from its closed to its open side, is provided with a dumping platform located beneath the screening surface, a pivoted chute located above the screening surface, a door connected with the chute and a rod connecting the platform with the chute. The chute is of such length as to extend from side to side of the casing and the connection between the chute and platform such that when the chute is closed the platform will be opened to discharge its load.

SCREW.—Philip W. Cassil, Garner, Ia.—This invention relates to screws having their plain or unthreaded portions bent or curved to adapt them to serve as hooks, and it has for its object the provision of a screw which can be conveniently screwed straight into an object by an ordinary screw driver. The invention consists in providing the head of the screw with a slot, the bottom of which is at an angle to the face of the head and perpendicular to the longitudinal axis of the body of the screw.

CAR COUPLING.—James M. Brown and Leo D. Peak, Exeter, Ill. This car coupling comprises a chambered draw-head, an elongated coupling link having a laterally hooked outer end, and a twist at the side rearward of the hook, the link being pivoted near its rear end at the rear of the draw-head chamber, a limb pivoted at the side of the coupling link and spring-pressed thereon opposite from the hook, and means to rock the link laterally against the pressure of the limb.

STEELYARD.—Charles H. Bartlett, Bristol, England. With the short arm of this steelyard are connected two sets of knife-edge centers at different distances from the center of suspension, and a single hanger provided with two sets of bearings adapted to rest on either set of centers indifferently, and having a shifting connection with the load suspension device whereby the load may be caused to bear through the hanger entirely upon the one or other set of centers. An adjustable weight carriage is adapted to engage with the notched lower edge of the steelyard, and is provided with notched indices referring to two scales on the same face of the steelyard. The steelyard is self-adjustable for light and heavy loads alike, and the weight is prevented from running down the tail of the steelyard when the latter assumes an inclined position. The denominations of standard weights may be read off from scales on the same side of the tail.

TRUSS PAD.—Smith Tucker, Medina, N. Y. The truss pad for which this patent was granted is formed of rigid material and constructed so that the pad will more effectively control the rupture, the pad being provided with ribs engaging the skin and serving to draw together the loose folds thereof.

APPARATUS FOR EXTRACTING PRECIOUS METALS.—Joseph R. Hebana, Butte, Mont. This contrivance comprises an amalgamated copper lining forming a cathode and a number of agitators each rotating on its own axis and at the same time traveling around the tank, the agitators forming an anode. Means are provided for connecting the agitators and cathode to a source of electricity. The object of the invention is the extraction of the nobler metals from their sulfid ores and of baser metals from their oxids.

WINDMILL.—Seth K. Humphrey, Boston, Mass. The inventor of this windmill mounts his vanes upon a rotating frame and connects them by means of crank arms attached to the vane shafts with an eccentric which is rotated about the main shaft in such a manner that the vanes will be rotated upon their shafts at one-half the speed of the rotation about the main shaft. There are also means whereby the angular position of the eccentric may be changed so as to throw the vanes out of operation, thus stopping the mill.

PIPE HANGER.—Theodor B. Sauer, Oberreifenberg, Germany. This invention comprises a clamp or shackle for holding tubes, and the invention is in general characterized by two clamping sections adapted to embrace the tube and having means for holding them together and a spike or shank rigidly attached to one section and designed to be driven into a support by which the shackle or clamp is held.

LOCK.—Robert H. Hearn, Dyer, Tenn. This lock has a locking bolt composed of a straight middle portion with a pivot hole at each end and offsetting curved locking ends at opposite ends and on opposite sides of its straight portion, each being described about the pivot hole of the opposite end and having bevel faces upon opposite sides, a lifting bar pivoted at one end to the case and having its other end resting beneath the upper end of the main bolt, a knob shaft and sleeve with tappets arranged beneath and acting upon the lift bar, and a supplemental key-bolt with tumbler arranged to be projected against the inner side of the end of the main bolt to lock it. The bolt can be operated by the knob shaft or be locked by a key so that it cannot be operated by the knob shaft.

MEDICINE DROPPER.—James B. Schermerhorn, Malden, N. Y. To the glass tube of this medicine dropper a rubber nipple is secured. A protective casing fits on the tube and has a recess on its upper face receiving the lower edge of the nipple and the adjacent edge of the tube, the side wall of the recess being undercut whereby to receive an adhesive substance. A stopper is fitted on the tube below the protective casing, to which it is secured, the stopper being of a diameter less than the casing, whereby the latter will project over the upper edge of the bottle in whose neck the stopper is inserted. By this means the dropper is protected against breakage and loss.

PHOTOGRAPHIC PLATE HOLDER.—Jacob Schaub, Salt Lake City, Utah. The object of this invention is to provide an improved photographic plate holder which will allow insertion and removal of plates with greater ease and celerity than heretofore, and by which the plates shall be more securely held in place, so that they shall be in no danger of being dislodged by jolting in traveling or otherwise. For this purpose the inventor provides the frame of the plate-holder with a hinged section which is arranged at the end opposite the slide entrance. When the slide is fully inserted it engages and locks the movable section, which, slightly overlapping the sensitive plate, holds it securely in place.

Designs.

BOX LID COVER.—Joseph L. Conway, Sioux City, Iowa. The leading feature of this design comprises a body portion, members projecting from the body at one end about right angles to one side face, and additional members at the opposite end ranging in a direction diagonal to a side edge of the body.

BOTTLE.—Constantine Wagner, New York City. In this design, the chief feature is a two-bored single neck rising from the apex of the tapering top of the bottle body, a portion of the neck appearing as depending from the top within the body, the exterior surface of the neck presenting an unbroken continuity in a transverse direction.

BRAKE SHOE.—Oliver B. Whitney, Marlborough, N. Y. The essential portion of this design consists in an approximately wedge-shaped shoe block having a straight base and a segmental base terminating in a wedge-shaped point, and formed with a depression having a narrow strip or tongue at one side of the shoe block, the strip terminating at or near the beginning of the wedge-shaped point.

SUSPENDER BUCKLE.—Aaron Coleman, New York City. This design consists of a front plate having the configuration of a miniature horseshoe with a conventionalized frog extending from the toe to the heels, a loop plate appearing with a serrated upper edge at the rear of the horseshoe-shaped front plate.

TIP FOR UMBRELLA OR PARASOL RIBS.—Charles H. Peddrick, Jr., New York City. The leading feature of this design consists of a bead arranged on a tip between the base and apex ends thereof.

PUZZLE BOX.—Hiram C. Clarke, West Winfield, N. Y. This design relates to puzzle boxes in which a labyrinth is provided, through the mazes of which marbles may be caused to travel, and the design consists in the novel configuration of the base and walls forming the labyrinth.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

LUBRICANTS, OILS AND GREASES. Treated Theoretically and Giving Practical Information Regarding their Composition, Uses and Manufacture. A Practical Guide for Manufacturers, Engineers and Users in General of Lubricants. By Lloyd I. Redwood. New York: Spon & Chamberlain. 1898. Pp. 54. Price $1.50.

The subject of lubrication is of constant interest, and while we already have some literature upon the subject, there is nothing which occupies exactly the same ground as the present work. The author has attempted to give engineers an insight into the properties of the various lubricants that are likely to be offered them and thus enable them to guard against the choice of one that would be likely to prove unsatisfactory for the purpose for which it is intended.

ANNALS OF THE ASTRONOMICAL OBSERVATORY OF HARVARD COLLEGE. Edward C. Pickering, Director. Vol. XLII., Part I. Observations Made at the Blue Hill Meteorological Observatory, Massachusetts, 1896, under the direction of A. Lawrence Rotch, A.M. Cambridge: John Wilson & Son. 1897.

This large pamphlet treats of the scientific aspect of kite flying for obtaining meteorological observations. It is illustrated by diagrams and is accompanied with a series of tables.

ALTERNATE CURRENTS IN PRACTICE. Translated from the French of Loppé and Bouquet by Francis J. Moffett. New York: The Macmillan Company. Pp. 376. Price $5.

The especial value of this work lies in the fact that its authors have endeavored to derive their information impartially from English, French, German and American sources. In this way they have endeavored to systematically traverse the entire field and treat in a practical manner the whole range of alternating currents of electricity.

MODERN AMERICAN DWELLINGS. With Constructive Details. By Numerous Architects. Practical Designs for Builders and Those Intending to Build. Illustrated by means of 33 half-tone engravings and 127 full-page plates of details. New York: David Williams Company. 1897. Price $3.

The selection of designs of residences in this volume is intended for the practical builder, who is frequently called upon to act as his own architect in the erection of dwelling houses. The designs range in cost from $2,000 to $5,000, and there is also a large number of details of the interior and exterior construction, a feature which the practical builder will recognize at once as of inestimable value in the building of houses. The designs represent work already executed and illustrate the efforts of architects scattered over a territory which includes practically the entire country. The half-tone engravings are well reproduced, but the elevations, while useful, are not particularly handsome. The floor plans are on a rather small scale. The details are specially to be commended.

MODERN SWITCHBOARDS. By Alfred B. Herrick. Philadelphia: The Cutter Electrical and Manufacturing Company. Pp. 200. Price $3.

While this handsome quarto volume, full of illustrations, is published primarily to set forth the business and describe the appliances manufactured by the Cutter Company, it is a book which cannot fail to be extremely valuable to the electrical engineer or to any one engaged in electrical work, as the abundant engravings represent a multitude of minute details not often found in a single volume. The book also has an interesting historical resume of early practices and expedients, indicating the advances recently made in electrical apparatus, and valuable data on approved methods of construction.

GREENHOUSE MANAGEMENT. By Prof. L. R. Taft, of the Michigan Agricultural College. New York: Orange Judd Company. Pp. 382. Price $1.50.

A manual brimful of valuable condensed and well arranged information on the forcing of flowers, fruits and vegetables in greenhouses is here presented to the public, the book also covering the propagation and care of house plants. To the florist especially, who pursues the business as a commercial enterprise, and to the growers of early vegetables and choice fruits, the work should be of great value, as not only are new and improved methods continually being brought into use, but the plants grown change from year to year, and this work of Prof. Taft is up to date in elucidating the most recent methods. The same author has also published a standard work on greenhouse construction.

HYDRAULIC AND PLACER MINING. By Eugene B. Wilson. New York: John Wiley & Sons. Pp. 234. Price $2.

The times are especially propitious, since the development of interest in the Klondike region, for publications on placer mining, which so many thousands of inexperienced men are now entering into in our Alaskan territory. The book before us is well adapted to set before the miner in a very practical way the leading features of the work, including methods of panning, cradling, booming, sluicing and the construction of riffles, flumes, ditches, valves, gates, weirs, etc.

THE CENTURY ATLAS OF THE WORLD. Prepared under the superintendence of Benjamin E. Smith, A.M., managing editor of the Century Dictionary, editor of the Century Cyclopedia of Names, etc. With 117 double page maps in color, 138 inset maps, 45 historical and astronomical maps, and indexes (883-x pp.) of places, rivers, mountains, etc. Published by subscription. New York: The Century Company. Cloth. Price $12.50.

The Century Atlas contains some of the finest specimens of map making we have ever seen. It is an entirely new atlas of the world, uniform in size with the Century Dictionary, which is known everywhere the English language is spoken or written. It is without doubt the most comprehensive and up-to-date atlas of the whole world, as it contains the latest details as to political changes, such as the new boundary of Greece resulting from the late war and the limits of Greater New York. The atlas has 117 double page maps, 138 inset maps and 45 historical and astronomical maps. They are printed in from five to ten different colors. The most recent government surveys of all parts of the world, the latest lake, sea and harbor soundings, the most recent explorations and the latest measurements of mountain peaks are given. The various railway, steamship and cable lines are all shown, and they are, of course, brought down to date. Important battlefields are plainly marked and the dates affixed. The historical maps illustrate the most important epochs of sacred as well as ancient and modern history. Standard time divisions are shown throughout in the United States and Europe; the special tourist map of Europe shows the chief routes of travel. As an example of what the older atlases lack and which the present atlas contains are the routes of celebrated explorers, including those followed by Nansen in his recent expedition to the Arctic regions and by Glave and Donaldson Smith in their recent African explorations. The index shows about 200,000 entries, and the foreign words used in connection with place names are translated, adding greatly to the utility of the atlas. The present time is particularly suited for the production of an entirely new series of maps, and the Century Company have done wisely in beginning at the bottom and making each map afresh from the newest and best material. The latest geographical surveys of civilized countries have been incorporated, and in those regions of the world for which no official surveys have been made, the most authoritative sources of information have been used. Space forbids us to enumerate all of the distinctive features which tend to make this atlas so valuable. The maps are clear and handsomely executed and bristle with details, to some of which we have referred.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Bicycle Electric Light Co., Cleveland, O., want agents.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Schwaab Stamp & Seal Co., Milwaukee. Send for cat'g.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7436) C. L. P. writes: I have a square dining extension table which has become somewhat marred by use, that is it has lost its polish. Can you tell me what I can do to give it the fine polish a new table has? A. Formulas for furniture polishes are given in our SUPPLEMENT, Nos. 1067, 1069 and 1145, price 10 cents each by mail.

(7437) H. B. D. writes: I have had great difficulty with X ray tubes becoming punctured by the passage of the current through the glass. What is the cause of this? A. To be punctured is the natural death of an X ray tube. When it will occur no man can tell, whether in infancy or in old age. The static machine seems to use up tubes faster than the induction coil. The spark jumps through the glass because under existing conditions that is the path of least resistance. Sometimes punctures seem to be preceded by a creeping out of an electric discharge upon the tube; at others there is a flash, a stroke and a hole. It is difficult to account for them. Two valuable works may be mentioned. "The Induction Coil in Practical Work," Lewis Wright, price $1.25 by mail, and "The Roentgen Rays in Medical Work," David Walsh, price $2.25 by mail.

(7438) P. L. G. asks: Will you kindly inform me, through the Notes and Queries of the SCIENTIFIC AMERICAN, the way to ascertain the distance from a receiver to the place that a submarine cable is severed? A. The general method of localizing a fault is to measure the resistance of the cable. This will be the resistance from the end on shore to the break, since the earth has no resistance. The resistance of the whole divided by the resistance per mile gives the number of miles to the place where the break occurred.

(7439) J. E. W. asks: How are electric lights tested for candle power? What apparatus is required, etc.? A. The best way to rate electric lights is by the power they use in watts. The National Electric Light Association has defined a 2,000 candle power lamp as one consuming 450 watts. This is 10 amperes at 45 volts. Incandescent 15 candle power lamps use from 50 to 55 watts. If the candle power is to be measured, the light of the lamp is compared directly with that of a standard. The legal candle is one consuming 120 grains an hour, made to have 6 to the pound. The method of comparison is to adjust the two lights till they illuminate a surface equally. Then the light of each is represented by the square of its distance from the surface. Thus, if the standard candle were 1 foot and the light to be tested 4 feet from this surface, the lights are as 1^2 to 4^2, or as 1 to 16. The light to be tested is giving 16 candles. This is explained in Hopkins' "Experimental Science." Price $4.

(7440) R. says: Please give a receipt for making cider, the cost to be about 16 cents per gallon. A. Mix well 10 gallons cold water, 7½ pounds brown sugar, ¼ pound tartaric acid, add the juice expressed from 2 or 3 pounds dried sour apples, boiled.

(7441) G. says: Kindly let me know how much a knot is. I would like to know whether it is a mile or a little over. A. A "knot" is a nautical mile and is equal to $\left(\frac{6080.27}{5280}\right)$ 1·15156 statute miles.

TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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MAY 17, 1898,

AND EACH BEARING THAT DATE.

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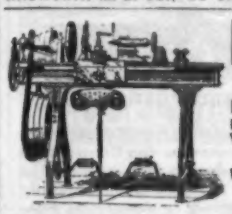

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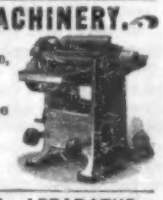

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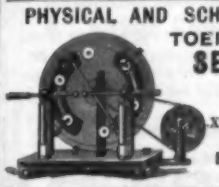

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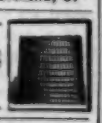

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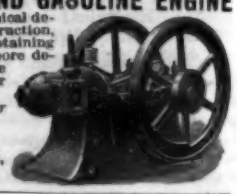

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Telephone switchboard plug, J. Taylor	604,094
Temperature controlling apparatus, H. S. Pease	604,077
Thawing apparatus, D. Phillips	604,264
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Thrashing machine band cutter and feeder, F. J. Wood	604,261
Tie. See Railway tie.	
Tile and arrangement thereof in roofs, J. Freund	604,035
Tile, self-adjustable and reversible, F. T. & H. A. Hopkins	604,325
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Tin plate, process of and apparatus for manufacturing, W. Rogers	604,195
Tire and means for attaching same, elastic, F. W. Morgan	604,067
Tire, elastic, F. E. Hall	604,042
Tobacco leaves, treating, Rickard & Long	604,336
Tombstone, J. B. Ford	604,354
Toy, A. M. Todd	604,180
Trolley, electric railway, S. H. Short	604,196
Trunk, dress skirt and wardrobe, S. W. Bonsall	604,346
Tube coupling, A. W. F. Bennik	604,294
Umbrella, self-closing, F. E. Stover	604,275
Undergarment, A. G. Velasco	604,103
Valve, H. Horbiger	604,326
Valve, hydraulic elevator, J. P. Davis	604,230
Valve, sewer, Z. Latshaw	604,117
Vehicle brake, R. M. Artus	604,286
Vehicle, folding road, W. Legge	604,331
Vehicle iron, adjustable, H. C. Swan	604,198
Vehicle, motor, G. W. Lewis	604,237
Vehicle motor, G. W. Lewis	604,332
Vehicle seat back rest, E. C. Alford	604,284
Vehicle wheel, H. F. Julian	604,154, 604,155
Velocipede handle, P. Racicek	604,216
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Washing machine, B. A. Fisher	604,032
Water heater, J. A. Stevenson	604,131
Water lifting machine, A. J. Vance	604,242
Wave or current motor, G. Lofgren	604,211
Wheel. See Paddle wheel. Vehicle wheel.	
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Wire stretcher, T. M. Guest	604,148

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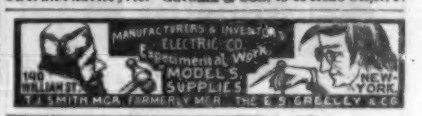

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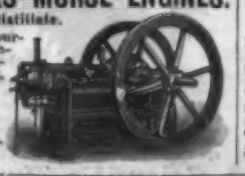

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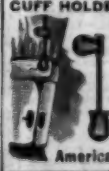

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